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"*To the solid ground*
Of Nature trusts the mind which builds for aye."—WORDSWORTH.

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THURSDAY, FEBRUARY 18, 1875

THE LOAN COLLECTION OF SCIENTIFIC INSTRUMENTS

WE do not think we are going too far in assuming that the unusually influential meeting held at South Kensington last Saturday may be regarded as the first and a very emphatic step in a most important work. What the nature of that meeting was will be seen from the following report, which has appeared in most of the daily papers :—

"A meeting was held at South Kensington on Saturday for the purpose of discussing the advisability of bringing together a loan collection of scientific apparatus. The Duke of Richmond, the Lord President of the Council, took the chair, the Vice-President, Lord Sandon, being also present. The following noblemen and gentlemen attended the meeting :—Lord Hampton, President of the Institute of Naval Architects ; Prof. Abel, Chemist to the War Department ; Dr. Allman, President of the Linnean Society ; Mr. W. B. Bascomb ; Prof. F. A. Bradley ; Mr. F. J. Bramwell, President of the Institution of Mechanical Engineers ; Mr. H. Cole, C.B. ; Admiral Collinson, C.B. ; Mr. G. Dixon, M.P. ; Prof. W. T. Thiselton Dyer ; Prof. G. Carey Forster ; Prof. E. Frankland ; Dr. Gladstone, President of the Physical Society ; Prof. Goodeve ; Mr. T. E. Harrison, President of the Institution of Civil Engineers ; Dr. Hooker, C.B., President of the Royal Society ; Prof. T. H. Huxley, Secretary of the Royal Society ; Mr. J. Norman Lockyer ; Mr. C. W. Merrifield ; Prof. Odling, President of the Chemical Society ; Prof. Ramsay ; Major-General Sir H. Rawlinson, K.C.B., President of the Royal Geographical Society ; Dr. Burdon-Sanderson, Vice-President of the Royal Society ; Mr. T. Savage ; Sir J. P. Kay-Shuttleworth, Bart. ; Mr. C. W. Siemens ; Mr. Warington Smyth ; Rev. J. Twisden ; Prof. Tyndall, President of the British Association ; Prof. W. C. Unwin ; Sir J. Whitworth, Bart. ; and Dr. J. Woolley. On the motion of the President of the Royal Society, it was unanimously agreed that such an exhibition would be most instructive and valuable. The question of the limits of the collection was discussed, and sub-committees were appointed to deal with the various branches of science to which it is proposed the collections should have reference. It was generally understood that the main objects of the exhibition would be to show modern apparatus for teaching and for research ; the applications of science to industry ; and such apparatus as is historically interesting from the occasions in which, or the persons by whom, it had been employed. The exhibition will be opened at the commencement of June. It is, however, doubtful at present whether all branches of science will be taken during this year, or whether the exhibition will be extended over two years, as the space disposable in the South Kensington Museum, where the exhibition is to be held, is rather restricted."

The presence at a meeting of this kind of two such influential members of her Majesty's Government as the Duke of Richmond and Lord Sandon may, we think, be taken as significant that the present Government is willing to do what it can for the advancement of science and of scientific education, and in order to do this, is seeking to learn what its duties are in the matter. The tone of the reply of the two above-named Ministers to the King's College deputation last week is quite in accordance with this view.

The meeting was altogether a remarkable one, consisting as it did of two of her Majesty's Ministers, together with many of the most eminent men of science in the country ; and their unanimity in favour of the proposal is a proof of its high importance, and we hope a guarantee of its success.

With regard to the proposal itself, the wonder is that no steps have long ere now been taken to organise a Museum for the illustration of the Physical, Chemical, and Mechanical Sciences. One of the recommendations contained in the Fourth Report of the Commission on Scientific Instruction and the Advancement of Science proposes the formation of a collection of physical and mechanical instruments, and submits for consideration whether it may not be expedient that this collection, the collection of the Patent Museum, and that of the Scientific and Educational Department of the South Kensington Museum, should be united and placed under the authority of a Minister of State. In our article on this Report (NATURE, vol. ix. p. 397) we went so fully into the subject that it is unnecessary to dwell again upon it now. Why the particular departments mentioned above should be left out in the cold it would be difficult to give a reason for ; probably, as we before suggested, it has been simply from want of thought ; and now that so many eminent men of science have met together, under the auspices of two members of her Majesty's Government, we may hope that the great gaps in our system of Museums will not remain long unfilled up. Natural History, including Geology, Zoology, Botany, not to mention nearly every practical application of science, such as Mining, &c., have, in London at least, resources for the practical study of their history and methods ; and we are exceedingly glad that this is the case. Greatly on this account, we believe, is it that these sciences are so popular, and that so much more is known about their results among the people at large, than about the various departments of the Physical Sciences. If a student in any of the above sciences wants to pursue an investigation on any point connected with their history, their methods, or their results, he has magnificent scope for so doing both in London and in other large towns throughout the country. But the unfortunate student of any department of the Physical Sciences — Electricity, Magnetism, Heat, Light, Chemistry—if he wants to study thoroughly or to investigate any point connected with his subject, has nothing for it but to buy his apparatus, borrow it from a friend, or perhaps only look at it in a shop window.

A collection which exemplifies the history of the progress of any science may be made both interesting and instructive ; and of all the sciences none can be more aptly and fully illustrated in this respect than the Physical Sciences. How interesting even to the uninitiated was the recent exhibition of a historical series of musical instruments at South Kensington ; but how much greater would be the interest that would attach to, and how much higher the instruction to be derived from, a collection of apparatus that would exhibit the progress in the single department of Optics, say from Newton down to Cornu and Fizeau, embracing as it might very well do all the work that has been done in recent years by means of the prism. So in the department of Heat in all its branches,

how intensely interesting and instructive a collection might be made. The mere mention of other subjects—Electricity, Magnetism, Acoustics, &c.—suggests possibilities of magnificent collections which might be formed, if only the public spirit of fortunate possessors could be properly roused; and on this latter point there need, we think, be no fear.

One condition, we think, ought to be insisted on: the collection which it is proposed to form should be almost entirely confined to the region of scientific research and instruction, and should include as little as possible of the practical applications of science, which, indeed, have hitherto had almost wholly their own way in our exhibitions and museums. It should be distinctly understood and acted upon, that the collection which it is hoped will be opened at South Kensington in a few months is meant to illustrate the history and methods of abstract scientific research, of the true nature of which the public know really nothing, and of teaching. Our friends the engineers and other practical men, we are sure, will see the fairness of our demand, and they are so powerful, and have hitherto been so largely represented, that they can well afford to be generous in this matter.

While one great value of the collection about to be formed will no doubt be from a historical point of view, it cannot but serve also an important educational purpose. It will let the public see how multifarious are the ways of science, will show them that it is no mere child's play, and tend to impress them more and more with the great importance of scientific education as a means of culture and mental training. When the claims of scientific research upon Government are advocated, those who are familiar with such a collection will know what is spoken of, and for what purpose the public money is wanted.

We hope, and indeed believe, that the experiment about to be tried at South Kensington is simply the first step towards something more permanent and much more extensive—in short, the fulfilment of the second part of the recommendation of the Commission quoted above. We believe that if such a collection is once formed, if it be properly organised and arranged and made perfectly intelligible to the public, both as to its theoretical principles and practical bearings, it will in time lead to a scheme as comprehensive, as complete, and as invaluable as the French Conservatoire des Arts et Métiers, to which we have frequently referred as a model which our Government would do well to copy. The unsatisfactory state of our Museums, their want of system, and incompleteness, we have often insisted upon. We think we are now on the road towards mending this latter defect; other defects can only be remedied by the adoption of the Commission's recommendation, to unite the principal collections under one responsible Minister of State. It would without doubt be greatly to the advantage both of the science and the industry of the country to have collected and arranged in one establishment, supported by Government, all the apparatus and illustrations of all the processes connected with every department of science, pure and applied, abstract and practical, instead of the heterogeneous and imperfect collections at present scattered in various buildings under different systems of management.

CAVE HUNTING

Cave Hunting. Researches on the Evidence of Caves respecting the Early Inhabitants of Europe. By W. Boyd Dawkins, M.A., F.R.S., &c. (London: Macmillan and Co., 1874.)

NO wonder that timid wanderers, peering into the dark mysterious depths of some abyss, should in their awe have peopled them with gnomes and goblins, or fancied themselves at the portals of another world. Well might poetic fancy, stirred by the thousand flashes thrown back from the spar-spangled walls of some vast cave, have called up fairy forms to give life to the beautiful stillness of the scene. Less weird and less poetic, but not less interesting, are the associations gathered by history and tradition around caves. We hear of rude tribes who habitually lived in rocky fastnesses occupying the caves for shelter and protection; and even when these were not used as permanent dwellings, we learn that in troublous times many a clan, family, or individual have had to leave their comfortable homes and betake themselves to the caves and holes of the rocks. We might well expect, therefore, that in the earliest age, when uncultured man fought for the richest hunting-ground, or struggled with nature for bare subsistence, the caves and rock-shelters should often have been his home.

We read again of the Patriarch purchasing the Cave of Machpelah as a burying-place for his family. Are we to suppose that this was a custom then newly introduced, or ask whether it was not probable that the associations of thought likely to spring up in the social life of the simple pastoral tribes of primæval man would not soon teach him to bury his dead out of his sight instead of casting them out to be devoured by wild beasts, and that he should then choose the tombs offered by nature and bury in caves? On searching for evidence on this point, we soon find that from almost the earliest time of which we can learn anything with respect to the human race, men lived and died in caves, and a later people of somewhat different habits buried in them; what the earlier race did with their dead is not quite clear.

Deposits in caves are generally more or less protected from the destroying agents which attack outside superficial deposits, and so we have in them a vast store of odds and ends, dropped, thrown away, or buried, which enable us to form a fair idea of the habits of the life of man long before the period to which history or tradition can reach back, and also of other creatures which lived with him or haunted the neighbourhood in those ancient times.

Caves are of all ages, and are formed in many ways. There are bone-bearing fissures of Rhœtic age. The phosphate beds of Caylus, full of bones of mammals, from early Tertiary to recent, are only ancient swallow-holes and caves. But the cave deposits we have to consider now are all post-tertiary, and are due almost entirely in the first instance to the decomposition of limestone rocks by the action of acidulated water. Mechanical action comes in afterwards and enlarges and finishes the work. There is, however, a difficulty as to how this action goes on in some sheltered places which rain cannot reach and where no water appears to run, such as many of the rock-shelters or abris. A probable explanation in some

cases is that a warm moist wind blows against a rock of lower temperature, and the vapour is condensed all over the surface. Minute vegetation at first, conspicuous mosses and lichens afterwards help the work, and the softer portions of the cliff melt away—here on a small scale, so as to leave marks somewhat like pholas borings; there on a large scale, leaving an overhanging sheltering ledge, such as may be seen in the sketch (Fig. 71, p. 249). Acidulated water, passing through cracks and fissures in the limestone rock, eats away the sides and enlarges its channel; but when it gets to the open air and is aërated in waterfalls or draughts, it gives off as gas the acid which helped it to hold the carbonate of lime in solution, and down this goes as stalagmite, or in some other form. Here we have a measure of time, as we can observe the present rate of accumulation, but we cannot get at any satisfactory results because the agents producing change are so many, so various, and so irregular in their action. It is not only, as Prof. Dawkins points out in the case of the Jockey Cap in Ingleborough Cave, that "it may be the result not of the continuous but of the intermittent drop of the water containing carbonate of lime" (p. 40), but the water continually stops up with stalagtitic accumulations the hole or crack through which it came; and so in many parts of that very cave we see a dry roof cross-barred with ridges representing joints, which once let water trickle through, but which are now sealed up with travertine.

Prof. Dawkins points out other sources of error in calculations based on the rate of accumulation of stalagmite.

But we have the order of succession of deposits containing various relics, and, where there is no reason for suspecting subsequent disturbance, the order is always the same. We have the identification of the style of instruments used by man, the groups of animals that lived at the different periods, with those of other deposits, the antiquity of which is measured by geographical changes. So, putting all the evidence together, we get a connected story.

Prof. Dawkins begins with the newer, and gives an account of how the civilised Celtic people were, after the Romans left, driven away to the west by the heathen Saxon—*y Saeson digred*, as they were called by the Welsh—and how they often had to betake themselves to the caves and holes of the rocks for shelter from their foes. Their remains have been found in the Victoria Cave at Settle, and the Kirkhead Cave on Morecambe Bay. Both of these are on the borders of the Cumbrian Mountains, to which the Celtic people were being pushed from the rich lowlands of Yorkshire and Lancashire, as, further south, they were driven into the mountains of Wales. Prof. Dawkins gives an interesting sketch of the history of this period; and, in commenting on the value of certain animals for purposes of classification, tells us when many of our pets and other animals were first introduced, and when many animals once wild in our country were exterminated. Though there is evidence that the dog had for ages been the companion of man, the cat seems to have been unknown before about the year 800 A.D. The common fowl and fallow deer seem to have been introduced by the Romans. The reindeer and beaver were wild in Britain after the Norman Conquest; the wild boar till the time of James I., and the wolf till long after the Civil War. These cave-folk were not prominent in history, but as their relics refer them to a time when events which are chronicled in history were happening in our country, Prof. Dawkins has described them under the head "Historic Period."

But the caves have yielded also the records of long ages before that; the iron, bronze, and polished stone ages. Of this period there is no contemporaneous history in Western Europe; but who knows how much of Egyptian, Assyrian, or Chinese history may tell of events synchronous with neolithic man in Europe? This period does not appear to have been cut off from historic times by any great physical changes, and, as we shall see by and by, the Britons of to-day seem to be in part descended from the ancient race that dwelt here in prehistoric times. They were a wide-spread pastoral people, sometimes dwelling in villages of huts on land, sometimes in wooden clay-patched houses standing on piles far out into a lake. They had domestic animals, and cultivated fruits and corn. As time went on, they acquired the use of bronze, then iron, and as they lapped round the outskirts of oriental civilisation, and its influence spread, some were absorbed and some driven back to the mountains. Who, then, were these people who lived just before our historic times? Is any part of the population of modern Europe directly descended from them, or were they all exterminated and their place taken by the invading wave of population? Prof. Huxley has pointed out the twofold type that may be found in some peoples that have for centuries been looked upon as one race. Cæsar, he reminds us, found two types of Celts in this country, the fair and the swarthy. In England of to-day we find, speaking English and calling themselves Englishmen, the same two types, the Xanthochroid and the Melanochroid. Huxley further points out that throughout the south-west of Ireland, South Wales, west and south-west of France, Spain, Italy, Greece, &c., the dark characters prevail, while anyone travelling from North Ireland across Scotland, Flanders, Germany, &c., would see none but fair people all the way. He thinks the dark complexions may have been inherited from Iberian ancestors, whose more direct representatives we have in the Basques. The fair-haired invaders did not exterminate, but absorbed or united with a great conquered population of dark-skinned people; and these two races, each we must suppose of great "prepotency of transmission," have handed down their distinctive characters for centuries; sometimes one, sometimes the other predominating. We must therefore bear in mind that the people included under the term "neolithic" in no way form one ethnological group. Neolithic is a useful temporary term to represent a phase of culture which different races reach and pass, and to which a different relative position in time must be assigned in different parts of the world. New forms, new metals, or new languages, may have come in with invading tribes and have been adopted by the now mixed race; but there is no evidence of an entire sweeping away of the older fashions at any period from neolithic times to our own.

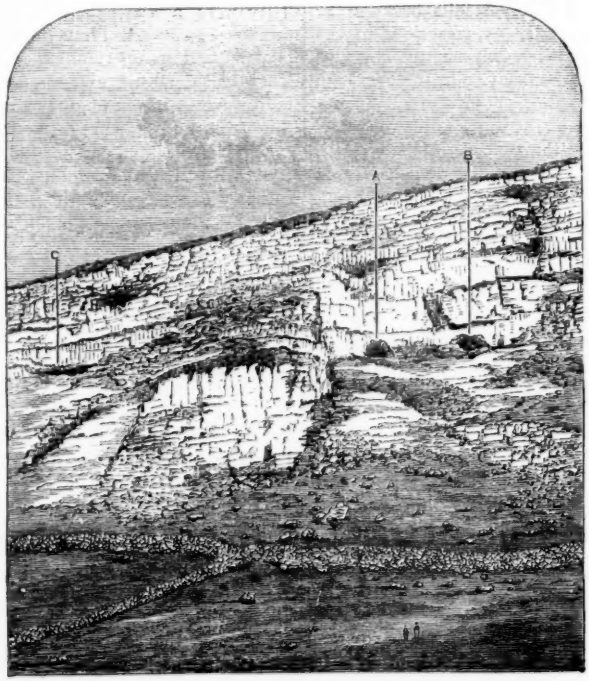
But long before those times also we have abundant records of man's sojourn in Western Europe. Who and of what race were these earlier or palæolithic folk? Their

state of civilisation and habits of life, inferred from their remains, point to the dwellers along the Arctic shores, and especially to the Eskimo, as their nearest representatives. Who the Eskimo are is not known, but a broad-skulled race seems to be following them from the east as the broad-skulled race of later neolithic times did the long-skulled people of the earlier neolithic age, who were separated from them by differences of racial character quite as strong as any we have in the present state of the evidence any right to assume existed between the neolithic dolicocephali and the palæolithic people.

Prof. Dawkins finds osteological affinities between the Basques and the earlier neolithic Troglodytes, and Mr. John Rhys follows this up by pointing out peculiarities of construction in the Welsh language which he thinks may be explained by the idioms having been derived from an Iberian tongue. It seems agreed that we have in the neolithic people a mixture of an Aryan and Turanian race. May it not be that the Basques are the direct descendants of a palæolithic tribe who were not quite absorbed, but who have gone through a neolithic phase of culture, and that the Eskimos may, when we know them, turn out to be another palæolithic tribe banished by the Aryan invaders to the far north, and living still in the same rude way that they did in palæolithic times?

However, this is at present mere speculation; the data before us do not furnish sufficient evidence to enable us to come to any satisfactory conclusion on this point.

There have been no great geographical changes since neolithic times. The hand of man has done perhaps



View of King's Scar, Settle, showing the entrances of the Victoria and Albert Caves (from a photograph). A, B, Victoria; C, Albert.

more than nature towards modifying the climate of Western Europe since that period. The surface of the country was then "covered with rock, forest, and morass, which afforded shelter to the elk, bison, and urus" (p. 262). When man had felled the woods and drained the land, the country must have become perceptibly dryer and warmer.

But, in tracing back the history of man, we meet with a great difficulty at the close of the early stone or palæolithic period. There is generally a gap. We ask, Why did not the use of polished weapons come in gradually, so that we might find a few polished weapons at first, then more as we search the deposits of more recent date; just as bronze and iron were gradually introduced among the stone-using people, but did not at once supersede the use of that material? Why, in the deposits along rivers and in caves, is there so often evidence of a great lapse of time between their occupation by the palæolithic and neolithic folk? Why is the group of associated animals so different? Why is it that, where deposits belonging to these two periods have been found together, there is generally evidence to show that they were separated in age by an enormous interval, during which considerable geographical changes have been brought about by the gradual operations of nature? This has induced many to seek for some cause of a general kind to explain the sweeping away of the old order of things, and the incoming of a new and different group. Of course geologists seek first an explanation in the glacial period. But wherever the deposits containing the remains of palæolithic man have been found in connection with boulder-clay, and their relation can be made out, the implement-bearing beds are

found resting on the drift in a manner that shows that they were laid there long after the deposition and even subaërial erosion of the glacial deposits.

In one cave on the borders of the Lake Mountains it was, and is still, hoped we may find out something more definite about the relation of the palæolithic to the glacial period.

In the absence of direct evidence, such as the overlap of boulder-clay over the mouth of the cave or the cave deposits, Prof. Dawkins remarks: "The probable date of the introduction of the contents into ossiferous caves in glaciated areas may be ascertained by an examination of the river deposits. If the animals found in the caves inhabited the surrounding country after the melting of the ice, their remains will occur in the post-glacial gravels. If they are not found, it may be inferred that they had retreated from the district before the latter were deposited" (p. 410); and, as Mr. Tiddeman has pointed out, there could be no pre-glacial remains in the gravels where there had been glacial erosion, as that must have swept out all the incoherent river deposits. By this test, Prof. Dawkins goes on to say, "the Pleistocene strata in the Victoria Cave, near Settle, may be considered pre-glacial, as well as the hyæna den at Kirkdale" (p. 411).

It was once thought that we were getting the direct evidence we sought for. At the entrance of the Victoria Cave, says Prof. Dawkins, "ice-scratched Silurian grit-stones are imbedded in the clay, which abuts directly on the cave loam, and passes insensibly into the clay, with angular blocks of limestone, within the cave. They may possibly be the constituents of a lateral moraine *in situ*, as Mr. Tiddeman suggests, or they may merely be derived from the waste of boulder-clay which has dropped from a higher level,"—that is, from the broken ground seen in the accompanying sketch on the left of the Victoria Cave. "The latter view seems to me to be most likely to be true, because some of the boulders have been deprived of the clay in which they were imbedded, and are piled on each other with empty space between them, the clay being carried down to a lower level and re-deposited" (p. 121).

Though we cannot yet make out clearly the relation of man to the glacial period, or explain the gap between palæolithic and neolithic deposits, this we do know—that man lived in this country and throughout Western Europe with the lion and hairy elephant, the hyæna, and woolly rhinoceros. He was probably more or less nomadic, following the urus and the elk, and shifting from place to place as they migrated with the seasons. That in his weapons of warfare and the chase he resembled the dwellers on the shores of Arctic seas, and from the associated animals probably lived when continental conditions and higher mountains produced much greater extremes of climate than are found in the same countries now. In many places he probably followed hard on the receding glaciers, before the advance of which, perhaps, his ancestors retreated. That although we cannot assign a date to his first or last appearance, we must refer him to a period so remote that wide valleys have been scooped out and whole races of animals have been exterminated since his time, but how long it took to bring this about we cannot yet tell.

Prof. Dawkins having qualified himself for the study by acquiring an intimate knowledge of the osteology of the animals apt to be found in such places, has been long engaged in collecting the evidence which caves furnish as to the early inhabitants of Europe, and has given us the result of his researches in a very readable volume, which, we doubt not, will reach another edition, and reappear with the correction of many small inaccuracies and inconsistencies, such as would be likely to occur in putting together the evidence collected through a series of years, during which Prof. Dawkins' own views were undergoing some change as new evidence was forthcoming, and the researches and views of other observers were being brought before him.

OUR BOOK SHELF

The Descent of Man, and Selection in relation to Sex. By Charles Darwin, M.A., F.R.S. Second Edition, revised and augmented. Pp. 688. (Murray: 1874.)

SINCE the first edition of this great work was reviewed in these pages (NATURE, vol. iii., pp. 442, 463), it has been repeatedly reprinted without any important change. But the new issue differs, not only in form, but also in many important additions, from the first. In spite of the added material, the whole work is now comprised in a single volume scarcely larger than one of the previous two. For this purpose the print has been much compressed, and the paper is thinner. The leaves have also been cut. So that although in some respects more convenient, the present form is less pleasing than the original one. We would suggest the desirableness of publishing a library edition of this and Mr. Darwin's other works, uniform with "Animals and Plants under Domestication," so that the *opera omnia* of our great biologist may stand ranged in a well-ordered row, printed in legible type with ample margin on opaque paper, fit to be clad in the sober dignity of russia. The present volume looks more like a school cram-book than a treatise which makes a generation illustrious. A prospectus has just reached us from Stuttgart of a German translation of the works of Mr. Darwin, by Victor Carus, to be published in numbers, with photographic and woodcut illustrations, portrait, indices, &c., and to be completed in ten handsome volumes. It would surely not be creditable were there to be no corresponding edition in English.

A list of the principal additions and corrections made in this edition of the "Descent of Man" is prefixed, and shows at a glance that the most important additions have been on the subject of Sexual Selection.

The whole treatise is now divided into three parts: The Descent of Man; Sexual Selection generally; and Sexual Selection in relation to Man. The two somewhat disjointed sections of the original work are thus combined into more of an organic unity. Beside innumerable references to the vast literature bearing on the subject scattered through the periodicals and books of travel of the civilised world, there is an important contribution by Prof. Huxley, on the resemblances and differences between the brain of man and that of apes, which occupies seven closely-printed pages. This and other valuable additions make this edition necessary to biologists as a work of reference, though most will probably prefer the earlier one for reading. P. S.

Manuals of Elementary Science. Zoology. By Alfred Newton, F.R.S. (Society for Promoting Christian Knowledge, 1875.)

A BIRD'S EYE view of a science from the hand of one who, during many years, has devoted most of his thinking time to the investigation of its principles and details, is certain to have a vigour and freshness about it which must be as

instructive as it is interesting to all who take the opportunity of glancing at it. There is a routine about educational works which is rarely diverged from to any considerable extent. Beyond the information they contain there is always a mass of oral tradition, glimpses into which only occasionally appear in print. This becomes, in many cases, the basis of the higher work of the succeeding generation, and to the student it is an invaluable adjunct to his more formal reading. In the small book before us, Prof. Newton has touched upon some of these less familiar points, bringing to the foreground several questions, the importance of which in the general economy of nature is scarcely sufficiently appreciated. He commences by a most instructive analogy, comparing the different members of the animal kingdom to a mixed collection of coins in a bag, whose history is to be determined mostly from what is to be found on their surfaces. Some, like fossil forms, are no longer current; in other words, they are extinct. Others, in their stamping give indications of the histories of the nations by which they were struck, as do organised forms by their external shape and internal structure; and so on. Upon this basis the principles of classification are, on an evolutionary foundation, established in a most lucid manner. An anecdote, particularly to the point, shows the fallacious reasoning into which students are likely to fall when they lay too little stress on the accuracy of the most minute facts, the mistake of a distinguished French naturalist with regard to the habits of the swallows found at Rouen being the instance given. The section on Geographical Distribution, when read in connection with the small map which is introduced, is as definite and precise as can be desired; at the same time that the observations on the effects of peculiarities in the physical conditions of life on the organisation of species have a bearing the full significance of which Prof. Newton has done so much to indicate. The remarks on nomenclature will also be fully assented to by all working naturalists. One of the chapters is devoted to a rapid sketch of the different classes of the animal kingdom; and this, when taken in connection with those on the subjects above mentioned, makes the little volume as complete an introduction as can be desired to the science of which it treats.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*]

Marine Boulder Clay, and other Deposits

IT seems from the concluding paragraphs of the report of the *Challenger* Observations in NATURE, vol. xi. p. 116, that the dredge has at length settled the question of the mode of deposition of marine boulder clay, and shown that in the Southern Ocean it is now being formed over areas perhaps as great as those now covered with similar deposits in the northern hemisphere. The facts stated show (1) The deposition of a bed of mud and sand with fragments of stones from floating ice; (2) That this deposit is so rapid as completely to mask or supersede the ordinary deposition of organic slime; and (3) That in certain areas of deep water there is a possibility that an excess of carbonic acid may remove all trace of calcareous organisms. It is further to be observed that, owing to the small amount of land, the conditions are probably much less favourable than those which existed in the north at the time of the great Post-pliocene subsidence.

These facts appear to me to confirm the conclusion which I have so often stated with reference to the boulder clay or "till" of North America, and which I have endeavoured to establish by the nature of the deposits now taking place in the areas of ice-drift on the coast of North America, by the distribution and chemical characters of the boulder-clay itself, and by the occurrence of marine fossils in it. It is to be hoped that in future we shall not have so confident assertion as heretofore, that these remarkable clays are due to the action of land ice, and that they will cease to be regarded as affording evidence of a "continental ice-cap" in temperate latitudes.

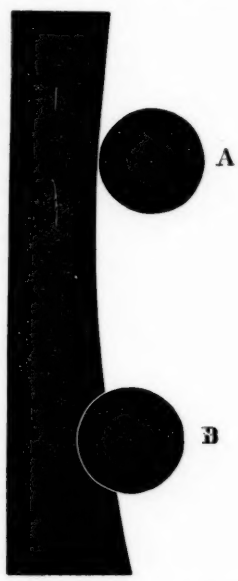
The details given in the same communication with reference to the formation of a "red clay" from the decomposition of organic ooze, in connection with the remarks of Prof. Williamson in NATURE, vol. xi. p. 148, are also very suggestive. They help to account not merely for certain red clays and slates and beds of silicious organisms, but also for the association of glauconite and other hydrous silicates with organic marine beds of all ages; an association which I have long held to be not accidental, though its precise chemical conditions may be obscure. The time may not be distant when geologists may learn to regard many deposits of this kind, from the Serpentine, Loganite, and similar minerals of the Laurentian up to the Modern Greensands, as products connected with the animal life of the sea, or dependent on it for their accumulation. Some chemical suggestions bearing on this will be found in Dr. Sterry Hunt's recent volume of "Chemical and Geological Essays," which I would commend to the study of all your younger geologists.

McGill College, Jan. 20 J. W. DAWSON

The Transit of Venus

AMONG the brief telegraphic accounts given in NATURE, vol. xi. p. 122, of the work done by the several Transit expeditions, is one from Janssen, in which it is stated that Venus was seen over the sun's corona before contact (which contact, external or internal, is unfortunately not mentioned).

The idea of the rim of light round the planet being due to the corona does not seem to have struck other observers; and there are one or two points, gathered from my own observations, for and against the conclusion, that I may perhaps be pardoned for bringing forward.



For the coronal view, then. I looked for, but failed to see, the retreating edge of the planet after last external contact. The air, however, was less steady than in the morning, and my eye was very weary with straining at the last tiny indentation made by Venus on the sun's limb.

Against the theory there are the facts that the line of light was apparently of equal thickness throughout, and at half immersion was visible up to the sun's limb without perceptible loss of light; that at first internal contact, or rather when the cusps had almost united and the solar light was but little cut off (*vide* A in diagram), the last portion of the ring was undiminished in brightness. Finally, in the pencil notes taken at the time, I find, referring to the ring of light, these words: "A brighter spot on lower limb, entering sun about ¾ immersion" (*vide* B). This spot I then imagined to be due to a portion of the planetary atmosphere, freer from cloud, and therefore refracting more light than the rest.

Taking Janssen's view, it may be accounted for by presuming the planet to have travelled over a bright streak of corona, or possibly an elongated prominence.

It will be interesting to know whether coronal structure was seen by any of the observers. E. W. PRINGLE

Manantoddi, Wynaad, Jan. 15

Ants and Bees

IN his recent paper on "Ants and Bees," Sir John Lubbock is reported to have said—alluding to the bees which had tasted the honey he had set for them:—

"If bees had the means of communicating knowledge, no doubt these bees would have told the others in the hive where

they could obtain a good store of honey with very little trouble, and would have brought a lot back with them."

Later on he says that he has come to the conclusion that what sometimes "appeared like affection was invariably dictated by selfishness."

Now, is the example given by Sir John of the want of communicative power afforded by the bee sufficient, or, indeed, any evidence of the fact? Is it not rather an excellent instance of the intense selfishness which governs the bee, in common with all other creatures, in its aim to prolong the life of the individual without a care for that of its fellows?

Again, Sir John says:—

"It was not altogether a selfish feeling which induced bees to show such eagerness to gather honey, for what they took to the hive was for the good of the whole colony."

This act seems to me to be in no way inconsistent with absolutely selfish motives. Bees find that there is strength in union, and that the winter months, which would kill them if left alone, they can survive by adopting principles of co-operation. The stronger the individual bee the more likely is she to derive benefit from the partnership, and a hive may, in fact, be regarded as a "tontine" association.

Lastly, when Sir John Lubbock says—"With regard to swarming bees by beating the warming pans, he thought there was nothing in it, but that it was an idea which had got possession of some people in the same way as many savage tribes believed that by making hideous noises during the eclipse of the moon they could frighten away the evil spirit which held her"—he would appear to have overlooked the fact that this is a practice arising from the peculiar ownership, of which, under English law, bees are the subject.

"Bees are *feræ naturæ*, but when hived and reclaimed a man may have a qualified property in them, by the law of nature as well as by the civil law" (Puff. c. iv. c. b. s. 5., Inst. II, l. 14.) "Though a swarm," says Blackstone, "lights upon my tree, I have no more property in them till I have hived them than I have in the birds which make their nests thereon, and therefore, if another hives them he shall be the proprietor; but a swarm which flies from and out of my hive are mine so long as I can keep them in sight and have power to pursue them, and in these circumstances no one else is entitled to take them."

Hence the origin amongst villagers of pursuing a swarm with the clamour of pans and fire-irons; not for the benefit of the bee, *quâ* bee, but in order to inform others that the followers are the possessors of the swarm.

It is easy to imagine that now some villagers may (confounding cause and effect) assert that the sound assists the operations of the bees or those of their hiver.

ALFRED GEORGE RENSHAW

Doctors' Commons, London

On the Value of the so-called Chameleon Barometer as an Hygrometer

A PIECE of filter paper soaked in a strong solution of cobaltous chloride ($CoCl_2$) is blue when dry, and red when moist; and I have found it very sensitive to slight changes in the quantity of moisture in the atmosphere, being more delicate than the thermometers I used.

The paper was suspended in a room, on the wall facing a south window, which was kept open during the day. By the side of the paper was hung a wet and dry bulb thermometer, reading to 2° Fahr., and observations were recorded three or four times a day for nearly a year.

I adjoin a few of the readings taken, as from their regularity it is unnecessary to give them all. The scale of change of colour was reckoned from 0 to 10, from red to blue.

It will be observed that for a difference of 13° between the two thermometers, the paper is quite blue, and it becomes red at a difference of from 1° to 3°. There is, of course, a limit to the change of colour, as when blue it cannot be any more blue, although the air should lose moisture. However, on the hottest day last summer it stood at 10, or maximum blue, for a difference of 13° between the thermometers, and when this difference fell to 12° the paper showed a decided change in tint.

It appears that the *actual* temperature has nothing to do with the colour of the paper, as it registers the same tint for the same difference between the two thermometers (with very slight variations) whether the day be hot or cold.

I think that such a paper is a handy addition to the thermometers, as you can see at a glance whether the air is wet or dry.

Date.	Dry-bulb Thermometer.	Wet-bulb Thermometer.	Difference.	Colour of Paper. 0 — 10.	Remarks.
July 8, 1874.					
1.30 P.M.	72	60	12	9	
5.30 ,,	74	61	13	10	Very hot day.
12.30 ,,	70	59	11	8·5	
July 10.					
9.30 A.M.	74·5	65	9·5	8	Much hotter than the
1.30 P.M.	77	67	10	7	8th, and yet paper
5.30 ,,	79	67	12	9	not so blue.
Sept. 30.					
1.30 P.M.	62	56	6	3	Barometer falling for
8.0 ,,	64	61	3	1	rain.
Oct. 1.					
9.30 A.M.	62	58	4	0·5	Rained in night.
10.30 P.M.	63	59	4	1	Barometer rising.
Oct. 2.					
1.30 P.M.	59	55	4	0·5	Bar. fallen, showery.
6.40 ,,	58	53	5	1	Bar. steady, cleared up. These two days show the paper to be more sensitive than the thermometers.
Oct. 23.					
1.30 P.M.	52	48	4	1	Wind N.
6.30 ,,	55	54	1	0	Wind W.
Dec. 3.					
10 A.M.	43	40	3	2	Sharp frost.

Rugby, Jan. 16 A. PERCY SMITH

Phosphorus and Carbon Disulphide

KNOWING the highly refractive power of phosphorus, and also of carbon disulphide, it occurred to me that a solution of the former in the latter might yield a liquid more highly refractive than any I had yet met with.

I could not succeed in making a solution so saturated that when another piece of phosphorus was put in it should not be affected. I made, however, an exceedingly concentrated solution. This solution had to be filtered. The clear liquid had the property of continually precipitating phosphorus, in what I believe was the red form. The solubility of phosphorus in carbon disulphide is very remarkable. Has it a definable limit? or is phosphorus, at ordinary temperatures, really a very viscous fluid?

Also I made a perfectly saturated solution of sulphur in carbon disulphide. This was much more easily accomplished, and it showed no tendency to change from its condition of a clear light-yellow coloured fluid.

A hollow glass prism, angle 60° was used, and kept in position of minimum deviation for sodium light for each substance.

Values of Refractive Indices are given in the following table:—

Refractive Indices.

	Lithium α.	Hydrogen C.	Sodium D.	Hydrogen F.	Hydrogen G.
P in CS_2 at 51½° F.	1·7548	1·7749	1·7780	1·8136	—
S in CS_2 at 51½° F.	—	1·6840	1·6890	1·7254	—
CS_2 alone at 55° F.	—	—	1·6321	—	—
Flint glass at 51½° F.	—	1·6193	1·6244	1·6370	1·6470

The hydrogen lines were obtained by a Geissler tube.

I do not give the measurements as more than near approximations, as I had no time to repeat them. They were made in the Cavendish Laboratory at Cambridge.

Harrogate, Jan. 21 CHAS. T. WHITMELL

The Micrographical Dictionary—Pollen Grains

IT is a pity that Mr. W. G. Smith (NATURE, vol. xi. p. 286) did not take the trouble to satisfy himself of the truth of Dr. Hugo

Mohl's statement, that the pollen of *Mimulus moschatus* and *Mimulus luteus* takes several forms, before writing his letter. I may inform him that the figure—in the "One Thousand Objects"—to which he alludes was *not* copied from the "Micrographical Dictionary," as he states. Had Mr. Smith first taken the pains to read what so excellent an authority as Dr. Hugo Mohl has written on pollen, and seen his figures, perhaps his remarks would have taken a different form. He may have observed but one form or one aspect of the pollen grains of *Mimulus* differing from the figures criticised, yet botanists will hesitate to accept his interpretation in opposition to so excellent a physiologist as Dr. H. Mohl, on the faith of his *ad captandum* observations.

M. C. COOKE

OUR ASTRONOMICAL COLUMN

VARIABLE STARS.—Amongst the stars which deserve attention on account of probable variability, the following may be mentioned; we take them in order of right ascension.

1. λ Eridani, first suspected by the late Capt. Gilliss, of the U.S. Naval Observatory, Washington. It has been variously estimated between mag. 4 (Lalande, Argelander, Heis) and 6 (Gilliss, Santini).

2. 33 Herculis. The variation of this star hardly admits of doubt. It is called 6 mag. by Flamsteed, Bradley, Piazzi (who observed it nine times), Taylor, and Robinson, and is so entered on Wolfers' Chart; Lalande calls it 7, and this is the magnitude assigned in the Radcliffe observations 1867-68. Bessel and Argelander (in the "Durchmusterung") considered it only 8; Gilliss also drew attention to this star.

3. Lalande 31384. In the "Histoire Céleste," p. 291, this star is called 6½. Sir John Herschel, in his third series of observations with a 20-ft. reflecting telescope, estimated it 5, and remarked that it is not in Piazzi. Bessel and Santini, who has four observations, call it 7; it is 5·5 in the "Durchmusterung," and 6 on Bremicker's Chart.

4. 41 ι Aquilæ looks suspicious; D'Agelet has four observations, 6, 4·5, 6, 6; Lalande two, 3½, 4; it is 5 in Piazzi, 4·2 in "Durchmusterung."

5. Piazzi XXI. 21. D'Agelet, who observed this star twice, calls it 8 on one occasion, and 9·10 on the other. It is 8 in Piazzi, 6 and 6½ in Lalande, 9 in Bessel, and 7·5 in Argelander (Durch.)

6. 17 ι Andromedæ. This star has been variously estimated between 3·4 and 7. Flamsteed says 4, Bradley 7, D'Agelet 3·4 in 1783, and 6 in 1784; Lalande twice calls it 5, and once 4; Piazzi, who has ten observations, 7; it is 4 in the Atlases of Argelander and Heis, and 3·9 in the first Radcliffe catalogue. Bradley and Piazzi compared with the Oxford catalogue, in which much attention was given to magnitudes, appear to certify the variability of light.

Piazzi I. 4, 16 Leonis Min., and 32 Vulpeculæ, one of Gilliss's suspected stars, also deserve attention, and observations of χ (Bayer) Cygni are especially desirable, great perturbations having been exhibited in the times of maxima of late years, which, with others previously indicated, it has not yet been found possible to represent satisfactorily by any formula. The variable is the true χ Cygni, Flamsteed having affixed this letter to his No. 17 in this constellation; the cause of it is now understood, Bayer's χ having been faint at the dates of Flamsteed's observations. The var. has (1875·0) R.A. 19h. 45m. 46s., N.P.D. 57° 24′.

Prof. Schönfeld, in his new catalogue, enters the Rev. T. W. Webb's variable in Orion, as *S* Orionis, and places it (for 1855) in R.A. 5h. 21m. 51s., and N.P.D. 94° 48′·7. As a first rough approximation to elements, he fixes a minimum to the beginning of December 1872, and assigns a period of from thirteen to thirteen-and-a-half months, the limits of variation 8·3 to less than 12·3.

OCCULTATION OF ANTARES, 1819, April 13.—We refer to this occultation on account of an interesting observation made by Burg at Vienna. He records the emersion on the dark limb of the moon at 12h. 3m. 22s. or 23s. apparent time, but remarks that at 12h. 3m. 17s·1 he noted the emergence of a star of from sixth to seventh magnitude, which after nearly five seconds suddenly appeared as a star of the first magnitude; and, writing to Bode, he suggests that Antares might be a double star, with the companion so close to the principal star, that good telescopes had not shown it. Bode's explanation was not a happy one. In a note he remarks: "Antares is no double star," and he goes on to attribute the phenomenon witnessed by Burg to the intervention of a lunar atmosphere. The Vienna observation, however, proves that the small star was then separated from the large one by a measurable quantity. It may be remembered that at the emersion of Antares in the occultation of 1856, March 26, which was observed by the late Rev. W. R. Dawes, at Wateringbury, and Mr. Whitbread, F.R.S., at Cardington, both observers noted the interval between the appearance of the small blue star and its bright neighbour as seven seconds; the difference of colour was very marked on this occasion; Burg does not refer to it. Occultations of Antares are coming on again, but no one of them is visible in this country up to the end of the year 1878.

ENCKE'S COMET.—From M. Stéphan's observations at Marseilles on January 27 and 29, published in M. Leverrier's *Bulletin International* of the 11th inst., it appears that Dr. von Asten's ephemeris gives the comet's place with great precision; indeed, the error on the 29th (the best observation) was less than fifteen seconds of arc. M. Stéphan remarks:—"La comète offre l'apparence d'une petite tache laiteuse, à peine perceptible, produisant sur la rétine plutôt des pulsations intermittentes qu'une sensation continue." We are able to add, that on the 31st ult. it was the *extremum visibile* with a 7-inch refractor. The following positions are for 8 P.M. Greenwich time:—

	R.A. h. m. s.	N.P.D. ° ′	DISTANCE from the Earth.
Feb. 21	0 10 25	81 5·3	1·818
,, 23	0 14 33	80 41·0	1·798
,, 25	0 18 49	80 16·1	1·776
,, 27	0 23 13	79 50·7	1·754
March 1	0 27 45	79 24·7	1·730
,, 3	0 32 26	78 58·2	1·705
,, 5	0 37 16	78 31·1	1·678

WINNECKE'S COMET.—Prof. Oppölzer considered that the error of his predicted time of perihelion passage in the present year would probably not exceed two hours. We find, on comparing the Marseilles observation on the morning of the 2nd inst. with his elements, that the error is likely to be within this limit, or about $0^d{\cdot}0764$, the predicted time too late. With this correction the error in geocentric longitude disappears, and that in latitude is very trifling.

MR. HAMILTON'S STRING ORGAN

IN the *Philosophical Magazine* for February there is a paper by Mr. R. Bosanquet on the mathematical theory of this instrument, in which, however, as it appears to me, the principal points of interest are not touched upon. As the remarks that I have to offer will not require any analysis for their elucidation, I venture to send them to NATURE as more likely than in the *Philosophical Magazine* to meet the eyes of those interested.

The origin of the instrument has led, as I cannot but think, to considerable misconception as to its real acoustical character. The object of Mr. Hamilton and his predecessors was to combine the musical qualities of a string with the sustained sound of the organ and harmonium. This they sought to effect by the attachment of

a reed, which could be kept in continuous vibration by a stream of air. Musically, owing to Mr. Hamilton's immense enthusiasm and perseverance, the result appears to be a success, but is, I think, acoustically considered, something very different from what was originally intended. I believe that the instrument ought to be regarded rather as a modified reed instrument than as a modified string instrument.

Let us consider the matter more closely. The string and reed together form a system capable of vibrating in a number, theoretically infinite, of independent fundamental* modes, whose periods are calculated by Mr. Bosanquet. The corresponding series of tones could only by accident belong to a harmonic scale, and certainly cannot coexist in the normal working of Mr. Hamilton's instrument, one of whose characteristics is great sweetness and smoothness of sound. I conceive that the vibration of the system is rigorously or approximately simple harmonic, and that accordingly the sound emitted directly from the reed, or string, or from the resonance-board in connection with the string, is simple harmonic. On the other hand, it is certain that the note actually heard is compound, and capable of being resolved into several components with the aid of resonators.

The explanation of this apparent contradiction is very simple. Exactly as in the case of the ordinary free reed, whose motion, as has been found by several observers, is rigorously simple harmonic, the intermittent stream of air, which does not take its motion from the reed, gives rise to a highly compound musical note, whose gravest element is the same as that of the pure tone given by the string and resonance-board. One effect of the string, therefore, and that probably an important one, is to intensify the gravest tone of the compound note given by the intermittent stream of air.

The fact that the *pitch* of the system is mainly dependent upon the string, seems to have distracted attention from the important part played by the stream of air, and yet it is obvious that wind cannot be forced through such a passage as the reed affords without the production of sound. A few very simple experiments would soon decide whether the view I am advocating is correct, but I have not hitherto had an opportunity of making them properly. I may mention, however, that I have noticed on one or two occasions an immediate falling off in the sound when the wind was cut off, although the string and reed remained in vibration for a second or two longer. A resonator tuned to one of the principal overtones was without effect when held to the string, but produced a very marked alteration in the character of the sound when held to the reed.

It will be seen that according to my explanation the principal acoustical characteristic of the string—that its tones form a harmonic scale—does not come into play, the office of the string being mainly to convey the vibration of the reed itself (as distinguished from the wind) to the resonance-board and thence through the air to the ear of the observer. A second advantage due to the string appears to be a limitation of the excursion of the reed, whereby the peculiar roughness of an ordinary reed is in great measure avoided.

I should mention that I have not seen anything of the instrument for the last six months, in which time I understand great progress has been made.

RAYLEIGH

ICE PHENOMENA IN THE LAKE DISTRICT

DURING the severe frost at the close of last year, some excellent opportunities were afforded of observing various phenomena in connection with the formation and fracture of large sheets of ice. After the ice had attained a thickness of some inches on Derwentwater and Bassenthwaite Lakes, the continued cold—with the thermometer for several days eight or nine degrees below the freezing-point (Fah.), even at mid-day—caused such shrinkage in the ice that cracks of great length were now and then produced with a noise almost like the firing of a small cannon. These cracks frequently passed quite across the lake, and presented many points of interest, especially to the geologist. In some cases two cracks met at an angle, as in Fig. 1; sometimes three cracks radiated from a central point, as we may often see in a cracked plate; and occasionally one long and wide crack would appear to have shifted others crossing it, just as a fault shifts beds or veins, as in Fig. 2, where the portions were shifted about two inches, and in the same direction in the case of several distinct cross cracks.

Some of the cracks were so much as two inches wide, and presented curious and interesting vein-structures. One class of crack was vertically veined, presenting the appearance of a number of thin sheets of opaque ice placed on end close to one another. Such cases reminded me strongly of vertically banded felstone dykes occurring a little north of Wastwater. Their formation may be explained thus:—The crack when first formed is exceedingly fine, but water soon finds its way into it, and freezing *quickly*, becomes a thin vertical seam of opaque ice. A second and a third opening of the crack occurs, and a new vertical sheet is formed each time. Thus the whole crack becomes filled, as it widens, with successive vein-like sheets of ice. At one spot on Bassenthwaite Lake I observed two of these veined cracks crossing one another, as in Fig. 4; the one of less width ran for about one foot in the direction of the other, and then passed out, maintaining the same general direction as it previously had. Here then was another example of what occurs so frequently among rock-veins, the newer vein conforming for a short distance with the direction of the older, and thus at first sight giving the appearance of its having been shifted by the latter. In this connection compare Fig. 4 with Fig. 2; in the latter case the smaller cracks seemed certainly to have been the first formed. At some spots quite a plexus of intersecting cracks were seen, and it was of interest to notice how frequently this combination resembled the faults laid down upon a geological map.

Another circumstance, suggestive on a small scale of geological phenomena, was the curious way in which the ice for about a mile and a half over the course of the Derwent, as it flowed into Bassenthwaite Lake, was raised into a low and broken anticlinal. For some time after the ice had formed over the greater part of the lake, a line, first of open water and then of thin ice, followed the river course for some distance, until its waters lost their distinctness in the general body of the lake. In the meantime, from the dryness of the weather and the continuance of the extreme frost, the ice subsided with the waters, and produced a gentle upheaval over the course of the river, which upheaval, however, seemed generally to have resulted in a more or less sharp ridge usually fractured in the direction of its length, and but seldom showing cracks of any size passing quite through from one side to the other.

Cracks showing a vertically veined structure have already been mentioned; these seem in all cases to have opened little by little, and to have been quickly filled with successive thin sheets of opaque ice; they probably never stood open and full of water for any length of time, but were the results merely of the contraction of the ice under the extreme cold. Another class of cracks, however, seem to have been wide and gaping during a thaw, and to have been suddenly sealed up by the freezing of the liquid contained between the sides. It is well known that as a general rule the more quickly a body solidifies from a liquid condition the greater the number of cavities—liquid and gaseous—it will contain, the liquid being frequently

* In the *mechanical*, not the *musical* sense

entrapped in the growing solid, and the gas not having time entirely to make its escape. In the case of many of these open cracks it would seem that the freezing took place so rapidly when it once began, that the air could not be all expelled, but the air-bubbles were lengthened out in their endeavour to set themselves free, and preserved in the form of very delicate tubes, pointing from the crack walls on either side slightly downwards and towards the centre, where solidification would last take place (Fig. 5). Along the central line of the crack occurred another series of perpendicular tubes caused by the elongation of the bubbles in the only direction then

FIG. 1.

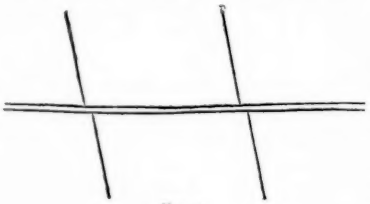


FIG. 2.

possible to them. Nothing could exceed the beautiful regularity of structure thus caused. In a few instances there was a double series of such an appearance as is represented in Fig. 5, the crack having again opened, apparently, along the same line, and a similar structure to the former having been produced. In this connection it is interesting to note the seemingly frequent evidence of fracture recurring along the same lines, especially if the explanation given above of the vertically-veined cracks be the correct one.

The drawn-out air-bubbles were also particularly beautiful around the stones and rocks in the shallow water at the edge of Derwentwater. Much of the very smooth ice which covered the lake on the morning of Wednesday, the 23rd of December, had been formed under a very sharp and sudden frost, the thermometer in a sheltered position registering 18° of frost. The ice would first form around the stones in shallow water, and form more quickly there than out in the open, where there were no marked centres of crystallisation; hence the number of bubbles entrapped were greatest around the stones and rocks close to the surface, at the lake-edge;

FIG. 3.

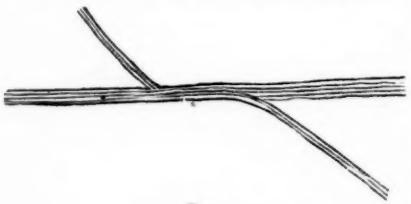


FIG. 4.

and the bubbles, trying to escape downwards as soon as the upper layer of ice was formed, became beautifully drawn out and fringed the stone most delicately. I have occasionally observed a somewhat similar lengthening of gas or liquid cavities when examining thin slices of such rocks under the microscope as have undergone solidification under tension in one given direction.

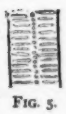


FIG. 5.

Before closing these few remarks, allusion may be made to two other effects noticed during the late frost. One of these is the precise analogy between the deposits of ice often formed on a rocky slope, or by constant dripping from above, and the deposits of carbonate of lime formed in caverns. The trickle of a thin stream of water over a rocky slope, such as may be seen in many parts of the Clapham Cave, deposits a wrinkled wavy layer of carbonate of lime, and over it the water seems ever to keep up a rhythmic flow. Upon rocks near the summit of Honister Pass I noticed during the late frost an icy sheet precisely similar, and with the same pulsating streamlet flowing over, while, hard by, there were sheets of icy stalactite and stalagmite only to be distinguished from those of limestone caverns by their greater clearness.

Another feature of great beauty was the effect of the bright sunshine on the icy crystals scattered broadcast over the snow of Skiddaw. Looking slightly away from the sun at a certain angle, and inclining one's head so as to look along the ground, there appeared scattered in boundless profusion thousands of brightly coloured gems, blue and green being the most marked colours, but many a ruby lying interspersed with these mountain emeralds. Assuredly Skiddaw top never showed to greater advantage than during those cloudless wintry days of the Christmas and following week; and it seems a marvellous pity that of the thousands who visit this favoured spot during the hot days of summer or the wet ones of autumn, so few should ever return to see their majestic friends

"Clothed in white samite, mystic, wonderful."

It may interest some to learn that something analogous to a Swiss glacier was once observed among our Cumberland mountains. Beneath the summit of Dale Head, 2,500 feet high, is an old copper mine, and many years since two miners entered the old workings in the month of June to obtain some mineralogical specimens. Great was their surprise to find the level, but a short way in, full of snow and ice. The mountain-slope is there very steep, but with many a hollow and rugged fissure in which the snow lies long, and doubtless it had found its way from above into the old level, as well as having been blown in at the mouth. The trickling of tiny streams among this snow, and the alternations of frost and thaw so frequent upon the mountain sides, must have produced an icy mass, which would be long ere it melted, and thus a natural ice-house was well supplied with ice far into the summer. The winter previous had, I believe, been a very snowy one, and it is not likely that the phenomenon is of very frequent recurrence.

J. CLIFTON WARD

SCIENCE AT BANBURY

AT the opening of a new Literary and Philosophical Society at Banbury the other day, Mr. B. Samuelson, M.P., gave an inaugural address in which he touched on various topics connected with the progress of science and scientific culture. We regret that our space prevents us from giving Mr. Samuelson's address at length; the following extracts, however, we believe, will interest our readers:—

"There have, doubtless, been times when the pursuit of learning was carried on with as much ardour, when as great sacrifices were made for the discovery of truth, or when there was at least an equal toleration for differences of opinion, as in our generation; but I think it may safely be asserted that at no period since the revival of letters in the fifteenth and sixteenth centuries have these conditions, essential as they are to the success of our objects, co-existed to the same extent as in our day. It may not be one of the least useful and interesting subjects of inquiry for our society how this favourable conjuncture has arisen. Probably it will be found to be one, and if so, certainly not one of the least important, of the results of the great material changes which have their origin in the substitution—begun in the age of Watt, and still in course of development—of machinery for manual labour. At any rate we may congratulate ourselves that the experience of the present age proves the dogma to be fallacious which

asserts that material wealth is necessarily associated with the decadence of intellectual vigour, or of the sense of moral responsibility. What the Roman poet said of the Augustan time, 'Aetas parentum pejor avis tulit nos nequiores, mox daturos progeniem vitiosiorem,' cannot with truth be said of our age and country. . . .

"Our funds will of necessity be limited at first, and it will hardly be in our power for some time to come to procure for our subscribers regular courses of lectures either in literature or science. Nor, indeed, do I think that the ordinary popular lectures are on the whole of any permanent value beyond the intellectual excitement which they produce. Their tendency in too many instances is rather to discourage than to promote study. When we have witnessed the brilliant experiments and listened to the luminous expositions of a Tyndall on light or magnetism, we are too apt to imagine we have carried away the solid instruction in those sciences which is in fact only to be acquired by close and persevering application. And this applies equally to literature, as those amongst us who were charmed by the acute criticism and pungent satire of Thackeray in his day will scarcely fail to admit. I believe that we should do more good by having, in each of our sessions, one or two lectures by eminent men, setting forth the objects and boundaries of some great branch of literature or of science, and the best method of cultivating it. Such lectures would do as much as popular courses to awaken the interest of those hitherto unacquainted with the subject treated, and would stimulate them to private study; whilst they would be of greater value to those who have already some familiarity with it by enabling them to keep abreast of the most advanced knowledge of the day and directing them to lines of inquiry by following which they themselves may possibly extend its boundaries. . . .

"As an example of how little the theory of force is apprehended even in its most rudimentary form, by persons who have received a liberal education, I may mention the case of a landowner and member of one of the learned professions, who not long since consulted me about his barn machinery. He suggested water as the motive power, and, when I asked him how he would obtain the necessary fall, gravely proposed to raise the water from a canal at the foot of his homestead, by the very machinery which that water was to set in motion.

"It is probable that one or more of our distinguished members, on whose support we have to congratulate ourselves, will have the kindness to give us instruction of the highest grade in their special subjects; but there is probably not one of us who could not, by working steadily at some subject in which he takes an interest, and by a simple relation of the result of his studies and observations, contribute to our entertainment as well as add to our knowledge. It is one of the advantages of residence in the country, that it affords so many opportunities for the study of the natural history of animated life. The example of Sir John Lubbock's exquisite monograph on the fructification of flowers, composed in his leisure moments by a man immersed in public and private business, as well as occupied by the special pursuits to which he owes his scientific reputation, shows how much may be done in this way. . . .

"Our holiday tours also, whether at home or abroad, if we note carefully and relate simply what we have seen, will give us endless subjects for papers on ethnology, social and political economy, and archæology. . . .

"The establishment of a Museum is one of the objects contemplated by the gentlemen to whom we are indebted for the existence of our society, and there can be no doubt of the value of such an institution, even if it should not attempt anything beyond the collection of miscellaneous objects illustrative of natural history, and of that of our race and country. I remember well that when I was a child, the sight of a provincial collection of armour, of coins, and of other objects of daily use belonging to a period so recent as that of the Commonwealth and the Restoration, first enabled me to form a conception of history as of a reality instead of a dream."

*THE EDINBURGH BOTANICAL SOCIETY**

THE Botanical Society of Edinburgh numbers more than 500 members. Moreover, the Botanical Class of the University of Edinburgh is the largest in the three kingdoms; the number of pupils which attended it in the year 1874 was 354. We might reasonably expect, therefore, to find in the "Transactions" of the Society some evidence of the existence, in an environment apparently so favourable, of a flourishing school of botanical investigation. After, however, examining the present number with some care, it is impossible to avoid feeling considerable disappointment. To speak the truth, a great part of its contents might have been sufficiently gratifying to those concerned if printed in some local periodical, but they are quite unworthy of that more formal and wider circulation which they necessarily aim at by their present mode of publication. The valedictory address of the president, Mr. J. M'Nab, is mainly occupied with a discussion (but *apart* from any meteorological data) of the deterioration of the climate of Scotland, which it is well known he believes to have taken place. Amongst other facts which he adduces in support of it, is the present scarcity in Scotland of mushrooms! He takes occasion to point out that though the British climate is unsuitable for many plants such as *Rhododendron arboreum*, their hybridised descendants are able to represent them in our gardens. It is, however, by no means certain that *Bryanthus erectus* is, as the president stated, a hybrid between *Menziesia empetriformis* and *Rhodothamnus chamæcistus;* on the contrary, it appears to be identical with a form of the former species.—Mr. A. S. Wilson continues his remarks on *Lolium temulentum*, the seeds of which have long been believed to be poisonous, and an exception to the general rule amongst grasses. The poisonous qualities of *Lolium temulentum* are attributed, no doubt correctly, to the ergot, with which it is often infected. After separating the ergotised grains, Mr. Wilson made cakes of darnel meal, which he ate without experiencing any ill effects. It is mentioned *inter alia* (p. 49) that the first Swedish turnips raised in Britain were grown at Perth, in 1772, from seed sent by Linnæus. Rather unexpectedly in a botanical publication we come further on upon an account of a dredging expedition, headed by Prof. Carus, in Lamlash Bay.—Mr. J. F. Duthie gives a long account of botanical excursions near the Baths of Lucca; except as an extract from the journal of an ardent collecting botanist, it has no points of interest.

Mr. A. S. Wilson writes on the fertilisation of cereals, in which he holds, against most authorities, that wheat, barley, and oats are not wind-fertilised, but are self-fertilised before the anthers are expanded. In rye, on the other hand, his experiments led him to the belief that 56 per cent. of the florets are fertilised by the agency of the wind. There are some things in his paper to which exception might be taken. Thus (p. 95), speaking of the embryo (ovule?) of rye, he says it "may more properly be regarded as a cellular mass capable of evolving fifty embryos, one of which takes the lead in the ovary," &c. Mr. M'Nab, in a paper on "Climatal Changes in Scotland," reiterates his view already alluded to; while the annual temperature remains the same, he believes the summers to be cooler.

Dr. Stewart's list of the principal trees and shrubs of Northern India takes up nearly forty pages. It is a posthumous publication, and its precise usefulness is by

* Transactions and Proceedings of the Botanical Society of Edinburgh vol. xii. part 1.

no means clear. Brandis's "Forest Flora of North-west and Central India" is an admirable and scholarly book. With the preparation of this Dr. Stewart was at first associated, and the present list is apparently a rough draft of the ground intended to be covered by the more elaborate work. After testing Dr. Stewart's list in several places, it is clearly evident that it is a mere compilation of no value whatever, critical or otherwise. One example out of many will suffice: *Hopea floribunda*, Wall., is identified with *Shorea robusta*, the well-known *Sal.* A. De Candolle fell into this error; but seeing that Wallich's specimens are in London, Dr. Stewart might easily have avoided following him. The confusion in Indian botany is already sufficiently deplorable without importing fresh mystifications.

Mr. Etheridge, jun., F.G.S., contributes a notice of some newly discovered specimens of *Pothocites*, a carboniferous fossil which has been held to represent the oldest known angiospermous Phanerogam. A note on the Chinese Lan-hwa makes Prof. Balfour by some error speak of *Olea fragrans* as belonging to the *Orchidaceæ*. The remainder of the matter filling the 188 pages of this part contains nothing else worth noting.

THE RECENT STORMS IN THE ATLANTIC

IN reference to the suggestion contained in the last number of NATURE, p. 290, we notice in the *Times* of the 13th inst. the following telegram:—

"*New York, Feb.* 12.—In consequence of the continuance of intensely cold weather, the East River is totally blocked with ice, and the shipping on the Hudson River is seriously impeded. In all parts of the States travelling is almost suspended, and the present condition of things is without parallel in the history of the last forty years."

The cold weather appears to have set in during the Christmas week, and not to have abated in the end of January and the first days of February, when we in Western Europe were brought under the influence of the polar wind. It remains to be seen whether the gales abated in the Atlantic when both sides were brought under similar conditions. We find in one of the most recent numbers of the *New York Herald* a list of the several years in which the freezing of the East River occurred at New York. Our contemporary notes,—January 19, 1792; January 8, 1797; January 19, 1821; January 21, 1852; January 1854; January 8, 1856; January 17, 1857; January 23, 1867; February 1871.

It cannot be said that each of these years was cold in Europe as well as in the States; so that it may be asserted with some degree of probability that the freezing of the East River in New York, and the freezing of the Seine or the Thames, are not regulated by the same laws. Without going deeply into the matter we can say, *exempli gratia*, that in 1821 the first part of the winter was cold in Europe, but that the weather was milder among us when the East River was frozen. On the contrary, the whole of the winter in 1853–1854 was rather cold in our temperate regions. In 1857 the freezing of the East River occurred when the winter was beginning to get colder in Europe. But in 1871, the cold disastrous winter which helped so much the German armies was over, and February was rather mild, when the East River was bridged over by coalescing icebergs. Consequently the only point which can be easily settled is to ascertain whether differences of temperature between America and Europe are an indication of the existence of gales raging in mid-ocean. The interest of the suggestion is independent of the origin of the inequality of temperatures, which can be attributed to many different causes, but would take too long to enumerate, and which would lead to no immediate practical conclusion.

W. DE FONVIELLE

NOTES

THE British Eclipse Expedition in charge of Dr. Schuster sailed last Thursday in the Peninsular and Oriental Company's steamship *Surat*, for Galle and Singapore. Dr. Vogel, of Berlin, joins the expedition at Suez, and Dr. Janssen at Singapore. Prof. Tacchini, also a member of the expedition, is already at Calcutta. The Viceroy has chosen Camorta, in the Nicobars, and Mergui as observing stations. The English observers will proceed to Camorta, where, as Mr. Hind has already stated in NATURE, totality lasts 4m. 27s. Before the accident to the *Charybdis*, that ship had been detailed by the Admiralty for the conveyance of the observers from Singapore to Siam. The *Surat* passed Gibraltar yesterday, all well.

THE medals of the Geological Society will be awarded as follows at the anniversary meeting to be held to-morrow:—The Wollaston Medal to Prof. L. G. de Koninck, of Liége, a distinguished palæontologist, especially as regards carboniferous fossils; the balance of proceeds of the Wollaston Fund to Mr. L. C. Miall, of Leeds, who has done good work on the Labyrinthodonts; the Murchison Medal to Mr. W. J. Henwood, of Penzance, for researches in respect to mineral veins and underground temperature; and the Murchison Fund to Prof. H. G. Seeley, in aid of his researches in fossil osteology.

THE medal of the Royal Astronomical Society has been awarded this year to M. D'Arrest, for his great catalogue of Nebulæ.

CAPT. HOFFMEYER, Director of the Danish Meteorological Institute, has issued a circular in reference to his admirable Daily Weather Charts, from which it is gratifying to see that they have been well received by the meteorologists of Europe. He is resolved to continue the publication, although hitherto the subscriptions have not been sufficient to cover the outlay. In the hope, however, that the number of subscribers will more and more increase, Capt. Hoffmeyer will continue to issue the charts at the same price as heretofore; he will, moreover, issue charts embracing a larger portion of the globe than before, and giving, besides, some idea of the distribution of temperature. These changes in the charts have been adopted in accordance with the advice of the directors of various central institutions. He has rejected Mercator's projection in order to avoid the exaggerated dimensions of northern regions, and he has somewhat diminished the scale in order to be able to embrace more degrees of longitude. He has also placed beside the stations figures showing in centigrade degrees the observed temperature, without the correction for altitude. Subscriptions are received at the Meteorological Office, 116, Victoria Street, London, S.W., at the rate of 12*s.* 6*d.* per quarter, including cost of delivery. We hope that Capt. Hoffmeyer will be encouraged in his most laudable enterprise by an increased number of subscribers; it is the duty of all friends of science to do what they can to support so valuable a work.

THE tercentenary of the University of Leyden appears to have been a very brilliant affair. The delegates from other universities, to the number of over seventy, were treated with boundless distinction and hospitality. They came from Claudiopolis in the east, and Coimbra in the west, and from Finland in the north. Considerable disappointment was felt at no representative being sent by Oxford, and that no notice of any kind was taken of the invitation. No doubt Oxford will be able to render a reason for this seeming uncourteous conduct. The Universities of Cambridge, Dublin, and London were all represented. It is interesting to hear that amongst the honorary degrees none was received with so much applause as that conferred on Mr. Darwin.

NOTHING definite was the result of the deputation from King's College which waited on the Duke of Richmond and Lord Sandon last Thursday, to ask the Education Department to make a grant to the College from the fund for educational purposes, in accordance with the recommendations of the Royal Commission on Scientific Instruction and the Advancement of Science. The Bishop of London presented the case of the College very forcibly, and showed that it really needed and deserved help, but, as might be expected, no certain hopes were held out that any grant would in the meantime, at least, be given. It is, however, to some extent consoling to learn that the claims of the College have been talked over by the powers that be. But, as Lord Sandon said, "it is a large subject, involving other parts of the country," and it seems to us that it can only be adequately considered in connection with the duty of Government in connection with the scientific education of the country as a whole, and with the claims of scientific research.

SIGNOR TEMPLI, First Assistant at the Observatory of Milan, has been appointed to the directorship of the new Observatory at Arcetri, near Florence. The post has been vacant since the death of Prof. Donati about a year and a half ago.

THE Vice-Chancellor of Cambridge University invites the attendance of the members of the Senate on Friday afternoon, immediately after the Congregation, for the discussion of the following impor nt Grace, which has received the sanction of the Council of the Senate:—"That a Syndicate be appointed to consider whether any, and, if any, what representations should be made to the Government as to the importance of obtaining legislative authority for modifying the pecuniary and other relations subsisting between the University and the Colleges, and for enabling the University thereby to enlarge and improve its system of education."

THE Cambridge Museums and Lecture Rooms Syndicate draw attention to the increased necessary expense in maintaining the departments under their charge, and ask for an increase of 500*l.* a year to their annual grant—that is, 2,000*l.* instead of 1,500*l.* They point out that the Cavendish Laboratory requires a considerable annual outlay. The expenditure has been restricted on all sides, and the purchase of specimens which would have helped to fill important gaps in the collections has had to be declined in consequence of want of funds. The Syndicate also ask for leave to expend 610*l.* for fittings to the Geological Museum. The Vice-Chancellor invites the attendance of members of the Senate to discuss this report in the Arts School to-day, immediately after the Congregation.

THE *Sussex Daily News* publishes a letter from Mr. Henry Willett, hon. secretary to the Sub-Wealden Exploration Enterprise, defending the course adopted in commencing the second boring on the same site. To have done otherwise would have caused much delay and inconvenience. The decision appears to have given general satisfaction, there having been an encouraging accession of subscriptions. A depth of 40 feet has been reached in the new boring.

THE publishers of *Naturforscher* have just issued the first number of a monthly periodical which promises to be of very great service to workers in science. It is entitled *Repertorium der Naturwissenschaften*, and its purpose is to give monthly a list of the most recent papers in the various departments of physical and natural science. Only such papers are mentioned as describe the results of original research, and the titles are arranged under that of the particular publications in which they are contained, and which consist mainly of the Proceedings of the various scientific societies, foreign and British, along with some of the principal scientific journals. The intention seems to be to give the titles of all original papers wherever they appear, and no doubt, as the publication advances, its plans will be improved and developed. We would suggest that the names of editor and publisher, and the place of publication, should in all cases be given. The enterprise deserves the greatest success. The editorship is the same as that of *Naturforscher*.

AT Berlin a telegram has been received from the commander of the *Gazelle*, dated Akyab, the 15th inst., announcing that the observations of the Transit of Venus at the Kerguelen Islands were successful. Further accounts from Dr. Janssen show us that he was enabled to observe Venus eclipsing the coronal atmosphere of the sun, by using glass of a deep blue tint.

SOME amusing and characteristic blunders have been committed by the *Journal Officiel* of the French Government in its impression of the 13th February, when describing the observations of the Transit of Venus at the Sandwich Islands. The official journalist says that the Sandwichians looked at the transit with *blackened glass*, without the help of any telescope. He supposes, moreover, that Cook observed the transit at the Sandwich Islands in his second voyage. The fun of the blunder is that Tahiti, where the transit was observed, is now a French settlement.

WE learn from the *Kölnische Zeitung* of Jan. 29 that at the last meeting of the Academy of Sweden, Prof. Nordenskjöld intimated that M. Oskar Dickson, of Göteborg, has granted the means for a new Arctic Expedition, which is to leave Sweden in the spring of 1876 for Nowaja Semlja and the Kara Sea, in order to continue in these little investigated countries the scientific researches commenced by Swedish explorers on and round Spitzbergen.

THE February number of Petermann's *Mittheilungen* contains a new map of Chili on the scale of 1:2,000,000, along with a brief account of Chilian cartography. The same number contains a Geographical Necrology for 1874; a paper, by Prof. Hans Höfer, geologist of the Wilczek Polar Expedition, on the icebergs of Novaya Zemlya, about which hitherto little or nothing has hitherto been known; the first instalment of "Travels in High Armenia in the year 1874," by Drs. Radde and Siewers; and a lecture on the scientific results of the recent Austrian Polar Expedition, an abstract of which we hope to give in our next number.

PROF. SCHNETZLER, of Lausanne, has published a paper on some researches which he made with regard to the common frog (*Rana temporaria*). He had placed fertilised eggs of frogs into colourless glass vessels, and others into green coloured ones; he found the development of the young animals to be remarkably slow in the green glasses, and ascribes the fact to the total absence of ozone in these glasses. The colourless glasses contained ozone constantly, whereas in the green ones there never was a trace.

THE *Neue Freie Presse*, in an article dated from Rudolphswerth, in Carniola (Austria), Jan. 25, describes a slight earthquake that was felt there on that date. The oscillations began at a quarter past eight in the morning, and were repeated twice within a quarter of an hour; their direction was horizontal, the weather was dull and rainy; temperature + 10° C.

TWO earthquakes have been recorded in Algeria, and, singularly enough, are recorded as having been felt at the same hour, ten o'clock in the morning, the first on the 20th January, at Tlélat, and the second at Sido-Bel-Abbes on the 29th. The direction of the first oscillation was from south to north. Nothing is said of the direction of the second.

THE *Kölnische Zeitung* of Jan. 31 reprints a long article, taken from the *Göttinger Zeitung*, in which Prof. Klinkerfues severely criticises the German custom of admiring everything

that is foreign and deprecating native talent; he does this with special reference to an article which appeared in many papers in Germany, stating that the French astronomer, M. Camille Flammarion, had succeeded in determining the actual weight of a distant fixed star, and had found it to be about three times the weight of our sun. He points out that the result is correct, but is not a discovery of M. Flammarion. Prof. Krüger (now director of the Observatory of Helsingfors) had already in 1859 made and published his calculations, after having received from the writer a more exact determination of the orbit of the double star in question, 70 p Ophiuchi. Prof. Krüger then gave the following details: Mass of the double star = 2·74 times that of the sun; half of the major axis = 29·34 times our distance from the sun; distance from our solar system = 1,200,000 times the sun's distance from the earth. The ray of light requires 19¾ years to travel from the star to us (about the same time, Prof. Klinkerfues says, that German works take to become known in France). When the parallax of the star was determined still more perfectly, Prof. Krüger altered the above figures to 3·12, 30·3, and 1,271,700 respectively.

THE discovery is announced of a new planet (142) by Director J. Palisa, at Pola, with a telescope of 7⅔ ft. focal length. It appeared of the 12th magnitude, and on Jan. 28, at 11h. 23m. 47s. Pola mean time, under R.A. 8h. 25m. 56s.82, and Decl. + 18° 17′ 38″4, with a daily motion of − 1m. 6s. R.A., and + 2′·8 Decl. At the Düsseldorf Observatory the planet (134) is being observed and its elements exactly calculated.

THE *Kölnische Zeitung* of Feb. 7 contains an abstract of a paper read by M. G. Wex, at the Geographical Society of Vienna, on the decrease of water in rivers and sources. The author states that the results of his observations tend to show the constant decrease of the rivers of Germany and the increase of seas. It appears from them that the levels of the German rivers are now much lower than they were fifty years ago; viz., the Elbe 17 in., the Rhine 24·8 in., the Oder 17 in., the Vistula, 26 in., the Danube 55 in. As a reason for this decrease, the author gives the progressing devastation of forests, which causes a decrease in the atmospheric moisture they attract and convey to the soil and thence to sources.

THE parasite which Dr. Cobbold proposes to describe at the Linnean Society this evening is, we understand, of singular interest. The *Distoma crassum* has only once before been observed, when it was discovered some thirty years since by Prof. Busk. The curious thing is, that in the present instance a Chinese missionary and his wife have both become the victims of this large species of fluke, several specimens of which will be exhibited to the Society.

PROF. PARKER commenced his course of eighteen lectures on the structure and development of the skull on Monday last, in the theatre of the Royal College of Surgeons. The following was his programme: 1. Introductory; 2. Skull of Lancelet; 3. Skull of Menobranchus; 4. Skull of Frogs and Toads; 5. Skull of Snakes and Lizards; 6. Skull of Turtles and Crocodiles; 7. Skull of Birds (*Ratitæ*); 8. Skull of Birds (*Carinatæ*: 1. Schizognathæ); 9. Skull of Birds (*Carinatæ*: 2. Desmognathæ); 10. Skull of Birds (*Carinatæ*: 3. Ægithognathæ); 11. Skull of Birds (*Carinatæ*: 4. Saurognathæ); 12, 13, 14. Skull of Pig; 15, 16. Skull of other Mammalia Placentalia; 17. Skull of Mammalia non Placentalia; 18. Summary and Conclusion.

THE Emperor of Germany has conferred upon Mr. George Fawcus, the author of the Isometrical Pocket Drawing-board, the Order of the Golden Crown. The board will probably be used by the Prussian staff officers.

ON Feb. 11 a numerous meeting of ladies and gentlemen interested in the subject of female education met at Prof. Holloway's, in Oxford Street, for the purpose of discussing the details of a scheme for the establishment, at Egham, of a University for Ladies. Mr. James Beal presided, and there were also present Sir James Kay-Shuttleworth, Mr. Samuel Morley, M.P., Mr. D. Chadwick, M.P., Mrs. Fawcett, Mrs. Arnold, Mrs. Grey, Mr. E. Ray Lankester, and Dr. Richardson. Mr. Holloway seems thoroughly in earnest in his proposed scheme, and has already secured a site at Egham at a cost of 25,000*l*. He has set apart a quarter of a million to found the institution, and is prepared to give more if wanted. A committee was appointed to seek counsel from the most competent authorities on the subject, and report to a future meeting.

A *Times* telegram states that Dr. von Neumeyer, chief of the Hydrographic Office of the Berlin Admiralty, will be appointed director of the Deutsche Seewarte, the new official institution at Hamburg for the scientific exploration of the ocean and atmosphere.

M. GRAVIER, one of the staff of the Rouen Library, has presented the French Geographical Society with the "Canarian," a history of the conquest of the Canary Islands, and conversion of the islanders to the Christian religion. This learned historian has devoted himself to describe the establishment of the French in several parts of the world, and the deeds of the French adventurers. He has published already "The Discovery of Mississippi, by Cavalier de la Salle," and "The Discovery of America by the Normans in the Tenth Century." The "Canarian" is an admirable book, narrating the exploits of Jean de Bethancourt.

THE increase in the cultivation of beetroot in Europe for the manufacture of sugar is said to be causing great loss to the cane-sugar planters in Cuba, who have been at an enormous outlay for machinery and labour to produce the fine class of sugar that is exported from thence. Should the European manufacture and consumption of beet-sugar go on increasing as it has done during the past four years, serious changes are anticipated in the cane-sugar productions all over the West Indies.

TWO species of *Corchorus*, *C. capsularis* and *C. olitorius*, are generally accredited as the sources from whence the fibre well-known as jute, so largely imported for carpet and other descriptions of weaving, is obtained. These plants are chiefly grown in Bengal, but in the Madras Presidency *Hibiscus cannabinus* and *Crotalaria juncea* are popularly termed jute; so that some confusion has arisen as regards the identification of the plants yielding jute in India. This question has recently occupied the attention of the Government of Bengal, and from inquiries instituted it appears certain that the true jute (*Corchorus*) is not found in the Madras Presidency, and that the fibre sent from thence as jute is really referable to *Hibiscus* and *Crotolaria*.

IT is only a very short time ago since it was supposed that the origin of the true medicinal Rhubarb of commerce had been finally settled, and was the product of *Rheum officinale*, recently figured in the *Botanical Magazine*, and admitted in Flückiger and Hanbury's "Pharmacographia;" and already this comfortable arrangement has been disturbed. In a recent number of Regel's *Gartenflora* there is a figure of *Rheum palmatum* var. *tanguticum*, which is described as the "most genuine amongst genuine" rhubarbs, and as the sort imported into Siberia by way of Kiachta. It was raised from seed collected by Mr. Przewalsky in South-west China on the high plateau bordering on the high lands of Thibet. We are promised a review of the species of *Rheum* in an early number of the *Gartenflora*, by Maximowicz.

THE Ramie, or China grass plant (*Bœhmeria nivea*), which has excited so much interest of late owing to its proposed extended cultivation in India, seems to thrive in Cayenne, specimens having been shown at a recent exhibition in that colony and compared with plants grown in France. The Cayenne plants, which were grown on a comparatively poor soil, without manure and with little or no attention, were double in size and height to those grown in France. Three successive shoots were produced in one year.

THE additions to the Zoological Society's Gardens during the past week include a Peguan Tree Shrew (*Tupaia peguana*) from Burmah, presented by the Hon. Ashley Eden, new to the collection; a Cinereous Sea Eagle (*Haliaëtus albicilla*) from Japan, presented by Capt. Sidney T. Bridgeford; two Bonnet Monkeys (*Macacus radiatus*) from India, presented by Sir F. S. Gooch, Bart.; a Sykes's Monkey (*Cercopithecus albogularis*) from Africa; a Robbin Island Snake (*Coronella phocarum*); a Horned Viper (*Vipera cornuta*), from S. Africa, deposited; four Four-spotted Opossums (*Didelphys opossum*) from South America, purchased.

*THE PAST AND FUTURE WORK OF GEOLOGY**

II.

"WE now come to the more special ground of the geologist. Starting with investigations connected with the origin of the globe, he has to trace the changes it has undergone through the various phases of its history, to determine the causes of those changes, and the manner in which they were effected. Besides dealing with inorganic matter, he has also to study the character and distribution of all organised things inhabiting the earth in all former periods, their order of succession, and the relation of the several and successive groups one to another."

Referring to the theories of the other geologists and to the philosophy of Hutton, Playfair, and their successors, Mr. Prestwich said it is a question whether the license which formerly was taken with energy is not now taken with time. Small forces long continued, action frequently repeated, and maintained uniformity of operation, are accepted as sufficient to account for the formation of our hills and plains, for the Alps and the Andes, and for all the great general as well as special features of the earth's crust.

The points at issue are, firstly, whether our experience on these questions is sufficient to enable us to reason from analogy; and secondly, whether all former changes of the earth's surface are to be explained by the agency of forces alike in *kind and degree* with those now in action. Mr. Prestwich then states his reasons for answering these questions in the negative:—

"The value of experience with respect to natural phenomena depends upon whether they are symmetrical and not variable, or whether they are variable and unsymmetrical. In the one case, as any one part bears a given uniform relation to the whole, if one part be known the whole can be inferred; but in the other case, where the whole is made up of unequal and not uniform parts, the value of the evidence is merely in proportion to the number of those parts independently determined, or to the ratio between the duration of the observation and the duration of the time comprising all the phases of the particular phemonenon. Thus the path of a planet, the date of an eclipse, or the return of a comet, may be predicted with certainty by the determination of mere minute sections of their orbits, which in respect to time are infinitely small compared to the length of the cycle of revolution. On the other hand, the metamorphosis of an insect, the mean temperature of a place, or the character of a volcano, can only be accurately determined by a length of observation sufficient to embrace all the variations they respectively present in their several cycles of change. In the case of the insect, the time must be equal to the duration of the metamorphosis; in that of temperature a succession of years is needed to obtain a mean; and with respect to volcanoes, centuries may often pass before we become acquainted with all the irregular exhibitions of their spasmodic activity.

"The necessity for a much greater extension of time becomes yet more imperative when we come to deal with geological phenomena, such as those due to the action of elevatory forces, which are extremely varied in their nature,—being at one time exhibited by a raised beach a few feet high, and at another by a mountain chain whose height is measured by miles; or by the small displacement produced by an earthquake, and the rectilinear fracture of a county with a displacement of thousands of feet.

"In taking into consideration the weight of the evidence where the series is so variable and irregular, it is clear that the increment of value is only in proportion to the increment of time. One phase of the insect life, one year's record of temperature, a century's observation of the volcano, give evidence which, although of value *pro tanto*, as one link in the chain, is entirely inconclusive when applied to the whole length. So in respect to such geological changes as those just named, the value of our experience is only in the proportion of the length thereof to the duration or cycle of the phenomenon under investigation. Thus the elevation of mountain ranges have been events of rare and distant occurrence. It has been estimated that all the great chains can be referred to thirteen epochs: taking subordinate ranges, the elevation of the main mountain chains of the old world may certainly be limited to twenty such periods. Divide geological time (since the sufficient consolidation of the crust of the earth) by this or even by double this number, and we may form some conception of the length of the cycles involving changes of this magnitude. What that time was it is impossible to say; we can only feel how infinitely it exceeded all our limited experience. With respect thereto the experience of five hundred years is no doubt of value—one or two thousand years add further to it;—but after all, how insignificant that duration of time is compared to the time over which the cycle extends; it may be as 1 : 100, or it may be as 1 : 200 or more, and I shall show presently that there are circumstances which indefinitely extend even these proportions. I conclude, therefore, that our experience in these cases is by far too limited to furnish us with reliable data, and that any attempt to reason solely from part to the whole must prove fallacious. Another argument adduced in support of this theory is, in my opinion, equally untenable.

"It is asserted that taking the degree of elevatory force now in operation, and allowing quantity of time, the repetition of the small changes on the surface witnessed by us would produce in time results of any known magnitude, *i.e.* that the force which could elevate a district 5 feet in a century would suffice in 100,000 years to raise it 5,000 feet. This reasoning might be conclusive if we had cause to suppose that the force were uniform and constant; but even our limited experience shows this to be irregular and paroxysmal, and although the effects indicate the nature of the force, they in no way give us a measure of its degree.

"Before I proceed further I must remove two objections which have been urged against what has been called the cataclysmic theory in opposition to the uniformitarian theory, both terms in themselves objectionable from their exaggeration, as all such terms usually are. One is, that we require forces other than those which we see in operation; and the other, that it is unnecessarily sought to do by violent means that which can be equally well effected by time. It is not, however, a question we raise as to the nature of the force, but as to its energy—it is not a question of necessity one way or the other, but of interpretation; it is a question of dynamics and not of time, and we cannot accept the introduction of time in explanation of problems the real difficulties of which are thereby more often passed over than solved. Time may and must be used as without limits; there is no reason why any attempt should be made either to extend or to curtail it; but while there is no need for frugality, there is no wisdom in prodigality. After all, it will be found that whichever theory is adopted, the need will not be very different; the mountain range, for the gradual elevation of which the one will ask 100,000 years, the other may require for its more sudden elevation a force taking the same number of years to accumulate its energies.

"We must, however, judge of the past by the features it has stamped on the land,* and these we must interpret not entirely by our own experience, not alone by our estimate of force, but by our knowledge of what amount of force the energy due to the thermal condition of the globe can develop on known dynami-

* Inaugural Lecture of J. Prestwich, F.R.S., Professor of Geology in the University of Oxford. Delivered January 29. Continued from p. 292.

* The evidence of facts with respect to the glacial period has already led to the admission of a greater intensity of cold; so we contend that the evidence of the past is equally definite respecting the greater intensity of energy

cal principles, and by our observation of what those forces have effected in past times.

"However we may differ in our interpretation of the present thermal state of the globe, most geologists agree in accepting the hypothesis of central heat as the one best in accordance with known facts relating to subterranean temperature, the eruption of igneous rocks, the action of metamorphism, and the crushing and contortions of rock masses. The radiation of heat into space has been accompanied by a gradual contraction of the central mass, and a shrinking of the crust, to which the trough of oceans, the elevation of continents, the protrusion of mountain chains, and the faulting of strata are to be attributed. The question is whether that contraction was accompanied by a like gradual yielding and adaptation of the solid crust to the lessening circumference of the globe; or whether the resistance of so rigid a body was only overcome by paroxysmal efforts. This latter was the view held by most of our early geologists, and is still the prevailing one abroad.

"It is not necessary to deal with the first steps of the problem. Let us take it after, for example, the readjustment of the crust, when it must have been many miles thick, which resulted in the elevation of such a mountain chain as that of the Alps; and here I must assume a point in advance. The resisting strata having given way to the tension to which they had been subjected, a state of equilibrium and repose would for a time ensue. As the secular refrigeration subsequently proceeded, the tangential force due to contraction resumed action, and while the larger areas were depressed chiefly by the action of gravity, other and smaller portions of the crust presenting the least resistance yielded, and rose at right angles to the tangential pressure.

"Now, either, if the elevatory force were limited and uniform in degree, a point would be reached at which that force was balanced by the increasing resistance and weight of the strata, and the movement would cease; or else, if the energy was a constantly generated quantity, and the rigidity such as to prevent yielding beyond a certain extent (and no solid crust can be perfectly flexible), then it would be a dynamical necessity that a time would come when, from the accumulation of that energy, it would overcome the resistance, and the opposing strata be suddenly rent and fractured. This primary resistance removed, the full power of the elevatory force would be brought to bear upon the disjointed mass, and the surplus energy expended in at once rapidly forcing forward and tilting up the now yielding strata, along the line of fracture, to that position and that height required to restore a state of equilibrium, and no more. It is not possible for any number of minor forces, where the ultimate resistance exceeds each one taken separately, to accomplish in any time, however long, that which requires for its execution a major force of infinitely greater power.

"Either a minor force, if sufficient to move a given weight, will go on moving, or else, if from any cause a further or secondary and independent resistance, such as, in this case, that dependent on the cohesion of the strata, has to be overcome, additional power must be brought to bear, which, if that secondary resistance be then overcome, the cumulated force being far in excess of the residual resistance, will be immediately expended with energy in proportion to the magnitude of the resistance mastered.

"Again, in the case of large faults traversing thick masses of strata, the conditions are nearly the same.

"The results of the foregoing conditions are in perfect accordance with observation. The enormous crumpling and folding of the strata—the vast upthrow of their disjointed edges—indicate the resistless forces which have been at work. Of these forces it is as difficult for us to realise the intensity as it is to fathom the immensity of space.

"While thus refrigeration progressed and the shell of the globe became thicker, other causes came into operation to give it greater rigidity, and so better fit it for the habitation of man.

"In the many discussions to which this question has given rise, it has been too much assumed that the shell was of uniform or nearly uniform thickness; the irregularities of the upper surface were apparent, but those possible on the under surface have been overlooked. I have, however, reason to suppose from some researches in which I have been engaged, that the under surface of the shell is ribbed and channelled in a manner and on a scale materially to influence the operation of that tidal action on which so many able and elaborate calculations have been based.

"Let us take on a continental area, having a mean surface temperature of 55° F., a point in the earth's crust through which any isotherm of depth passes,—suppose it to be that of 1,000°. This earth-isotherm will possibly be found about a depth of about 50,000 feet. The isothermal plane must approximatively follow the contours of the surface, and in mountain districts may rise some 1,000 to 4,000 feet above its other level."

Mr. Prestwich then shows that to the depth of the ocean we have to add a depth equivalent to the difference between the mean temperature of the adjacent land and that of the deep waters.

"As the position of the other earth-isotherms will in like manner occupy successive planes approximatively parallel with the surface whether of land or sea-bed, it follows that, if a central molten nucleus exists, it will be divided into areas separated by boundary lines, no less important than those formed by the continental areas between the several oceanic areas on the surface; and as they are even more enclosed and isolated, their condition with regard to the possible existence of tides would approach more to that of an inland sea such as the Mediterranean, where their influence is scarcely felt. It may be a question also whether the rigidity of the earth's crust is not influenced by this mode of structure. It must certainly affect the permanence of continental and oceanic areas.

"Notwithstanding this, it may naturally be asked in view of the more constant slow changes and movements to which, in past times, the crust of the earth has been subject, and that even up to a period so geologically recent as the elevation of the Alps and the Andes, how it happens that it is now so quiescent and comparatively immovable." Mr. Prestwich showed that the hypotheses both of Mr. Hopkins and Sir W. Thomson grapple with this difficulty, and in the same connection refers to the theories of Mr. Mallet. Mr. Prestwich is not, however, satisfied with the conditions suggested by these distinguished physicists, and is led to seek for other causes to account for the present stable condition of the earth.

"The cause which suggests itself to me," he said, "is the intense cold of the glacial period through which the earth has so recently passed, and which has, as it were, anticipated the refrigeration which, in ordinary course, would have taken a longer time to effect. At present the annual variation of temperature in these latitudes extends to a depth of about 30 feet; the maximum heat of summer being felt by the end of November, and the maximum cold of winter by the beginning of June at a depth of 26 feet. But supposing the cold of winter not to alternate with summer heat, then the abstraction of heat would continue to a depth in proportion to the length of time during which the cold at the surface was maintained and the degree of that cold, and such would be the effect over a large portion of the northern hemisphere (and I believe of the southern contemporaneously) during the glacial period. For as permanent ice and snow then extended down to these latitudes, the summer sun would not sensibly affect surfaces so covered, and the abstraction of heat must have proceeded uninterruptedly. To what depth the effect may have extended has not yet been investigated, but that it must have been very considerable is evident from the depth to which the annual variations are now felt. Consequently, with a uniform permanent temperature of 32°, or lower, at the surface, and with the long duration of the glacial period, we may form some conception of how far beneath the surface the extreme cold must have extended; even now, in parts of Siberia, the ground is permanently frozen to a depth of 300 to 400 feet. Then the surface temperature in these latitudes, instead of commencing as now with a mean of 50°, and attaining 70° at a depth of 1,000 feet, commenced with a temperature of 32° F. or less, and the isothermal of 70° must have been depressed far below its present level. On the return of the present more temperate climate, that portion of the crust of the earth, measuring certainly many hundreds, and possibly some thousands of feet in depth, which had suffered from this abnormal loss of heat, would have to recover its equilibrium with existing conditions by another change in the isothermal planes, and, until that was effected, little or no loss by radiation would take place.

"Or, to look at it in another way, let us suppose periods of equal temperature before and after the glacial epoch. As the radiation of heat is in proportion to the difference of temperature between the warm body and the surrounding medium, the loss of heat by the earth would, if no colder period had intervened, have been nearly equal in equal times; but with the greater cold of the glacial epoch, the same result would be effected in a shorter time; or, what is tantamount, the loss in the same time during the glacial period would be greater than in the other two periods. Thus, supposing we take any given time of the glacial period as

producing a refrigeration of the crust equal to that which would be effected in a certain longer time of the pre-glacial or post-glacial periods, then for a certain term of time—of length bearing some proportion to the difference between the two—succeeding the glacial epoch, the earth would, with its outer crust so much below the normal, lose little or no heat by radiation, so that during that subsequent period the thermo-dynamical effects due to cooling would be reduced to a minimum or cease altogether, and a period of nearly staple equilibrium, such as now prevails, obtain.

"This last great change in the long geological record is one of so exceptional a nature that, as I have observed elsewhere,* it deeply impresses me with the belief of great purpose and all-wise design, in staying that progressive refrigeration and contraction on which the movements of the crust of the earth depend and which has thus had imparted to it that rigidity and stability which now render it so fit and suitable for the habitation of civilised man; for, without that immobility, the slow and constantly recurring changes would, apart from the rarer and greater catastrophes, have rendered our rivers unnavigable, our harbours inaccessible, our edifices insecure, our springs ever-varying, and our climates ever-changing; and while some districts might have been gradually uplifted, other whole countries must have been gradually submerged; and against this inevitable destiny no human foresight could have prevailed."

SCIENTIFIC SERIALS

THE *Journal of Botany* for December 1874 and January and February 1875 contain quite the average of papers of general interest. Among the original papers may be mentioned in particular one on the critical species *Triticum pungens*, and another on *Rumex maximus*, by the Hon. J. Leicester Warren; descriptions of new species of Scilleæ and other Liliaceæ, by Mr. J. G. Baker; a list of the wild flora of Kew Gardens and pleasure-grounds, by G. Nicholson; *Anthoxanthum puelii*, by F. Townsend; and the continuation of the paper on the Botany of the Maltese Islands, by Mr. J. F. Duthie. A larger proportion of the space than usual is filled by reviews of botanical works, English and foreign. The plates include two of new species of *Ascobolus*, to illustrate a paper by Mr. James Renny; *Anthoxanthum puelii*, recently discovered in the south of England; and *Carex frigida* and *Salix Sadleri*, the two recent additions to the Scottish flora made by Mr. Sadler.

THE *Botanical Magazine* for February contains figures of the following plants:—*Epidendrum syringothyrsus*, a handsome species from Bolivia, with large racemes of purple-red flowers, tinged with lilac. *Lilium canadense*, var. *parvum*, a very handsome miniature lily, regarded by some as a distinct species. It has small orange-red flowers spotted with purple-brown. *Veronica pinguifolia*, a shrubby species from New Zealand, with very pale blue flowers. It is hardy at Kew. *Fourcroya Selloa*, an agave-like plant from Guatemala, whose large flower-scapes were allowed to protrude through the roof of the Succulent House at Kew last summer, and must have been noticed by many of our readers. *Senecio macroglossus*, the plant with ivy-like foliage alluded to in a recent number. Lastly, a new genus, *Erythrotis*, of Commelyneæ: an exceedingly pretty trailing plant from Malabar, having small leaves of a most brilliant crimson on the under surface, and small bright blue and red flowers. The species is called *Beddomei*, after Col. Beddome, its discoverer.

Zeitschrift der Oesterreichischen Gesellschaft für Meteorologie, Jan. 1.—On the curved tracks of cyclones issuing from the trade-wind region, by Dr. W. C. Wittner. Water resembles air in many of its movements, and is more easily observed; its eddies and currents especially may be studied with advantage in connection with cyclonic phenomena like the above-named. When a stream of water is met by another at right angles, a depression is formed at the point of interruption; particles bordering this depression sink into it in obedience to gravity, and particles at a greater distance move spirally inwards. Besides rotation there is a progressive motion of the whole eddy, in the direction of the resultant of the forces of the two streams. In turbulent streams eddies last a very short time; they are filled up almost as soon as formed. In quiet rivers, on the contrary, the whirl continues for a length of time sufficient for observation. In the development of hurricanes, difference of air-density corresponds to difference of level in water. Hurricanes, like eddies, are destroyed when the surrounding medium moves very irregularly, and we should therefore look to the neighbourhood of the tropics, where atmospheric conditions are remarkably regular, for a region favourable to their growth and progress. Near the northern boundary of the region of calms, the equatorial current begins at about S., and the polar meets it from about E., nearly at right angles, so that in this respect also the development of whirls, like those in water at the junction of rivers, is favoured. The resultant progression, towards N.W., becomes deflected as the storm advances, until, at a latitude where the eastward component of the equatorial may be supposed to vanish against the westward component of the polar wind, an excess seems to remain of the southerly over the northerly component, causing movement towards N. In still higher latitudes the more westerly equatorial and northerly polar drive the cyclone in an easterly direction. Occasionally, when the northerly component of the polar happens to be stronger than the southerly of the equatorial wind, as in the storm of Oct. 10, 1847, the system moves towards S.W. In the southern hemisphere, as in the northern, the direction of rotation indicates an irruption of the anti-trade into the trade-wind. The equatorial current, or anti-trade, appears to be the strongest both by its invasion of the trade-wind region and by the direction of advance of the consequent hurricane.—A communication from Captain Hoffmeyer, in the *Kleinere Mittheilungen*, contains valuable remarks on the relation between pressure and rainfall. In Denmark, most rain falls on the front of a minimum, and when a considerable depression is near. Like Mr. Ley, he believes that, at least in Europe, minima are formed simultaneously with heavy rains, but thinks that they are not caused by them, only magnified. He has come to the conclusion that minima must be looked upon not as results of mechanical rotation, but as functions of existing conditions and differences. They seem to him to seek and require continual nourishment. The principle of a descending current in maxima, and an ascending current in minima, broached by Mr. Buchan some years ago, he considers the only one with which we can overcome the difficulties presented by these phenomena. Air is interchanged mainly by vertical currents, resulting from thermal inequalities. Vapour also plays a large part in *ascending* currents. Low pressure at the earth's surface is not an indication but a cause of the *courant ascendant*. With these views, and by the comparison of weather charts, we can in general explain the main features of the atmospheric condition, though not indeed its ever-varying relations. Dr. Hann, in reply, maintains his opposition to the theory of Espy and Reye, that the *courant ascendant* is the sole or chief cause of a minimum in storms, and objects that the heaviest rains in the tropics do not in the least disturb the regular daily movement of the barometer, and to assume that the same cause in similar conditions could produce opposite effects would be illogical. Tropical rains have not been proved less extensive than those of higher latitudes, as some have supposed them to be. We have no clear evidence that condensation and rain diminish pressure. On the other hand, mechanics teach us that pressure must diminish towards the centre of a whirling mass of air. From these reasons, we should seek for an explanation in the laws of dynamics.

THE *Bulletin Mensuel de la Société d'Acclimatation de Paris* for October opens with a paper by M. S. Berthelot on "The Domestication of Animals," in which the writer expresses the opinion that the domestication of animals is due more to the art and skill of man than to their natural qualities; though the aptitude for domestication is unalterable in those animals which naturally possess it.—M. Bouillod contributes a paper on the cultivation of wild turkeys, recounting his experience in the matter, the object of which is not clear, seeing the domesticated turkey cannot be excelled in any respect.—Silkworm culture occupies its usual prominent position in the report.—The rapid growth of the *Eucalyptus globulus* is exemplified by M. Laberenne, who planted some seeds in Algeria on the 29th April, 1873, which twenty-six days later had already appeared above ground. In September, 1874, some of the plants had attained a height of 65 centimetres (26 in.).—M. Drouyn de Lhuys, in a speech on the Phylloxera, suggests that new plantations of vine from seeds should be formed, which he thinks would more easily repel the attacks of the pest.—Germany is making advances in the culture of the silkworm, which are detailed in a letter by M. A. Buvignier.

Astronomische Nachrichten, No. 2,020.—Mr. S. Burnham contributes a note on certain double stars. Σ 410 and H 334

* Philosophical Transactions for 1864, p. 305.

are catalogued in identical positions, but he finds they are distinct stars, and the companion to Σ 410 is of 19 mag. of Herschel's scale. The companion of Σ 2749 shows an increase in distance and angle; the three stars are now almost in a line. The position of Σ 388 appears to have increased 100° since 1835.—J. Pebbutt gives position observations of Coggia's Comet, together with comparison stars. J. C. Watson sends a note on his discovery of Planet (139) at Pekin.—The elements and an ephemeris of Borrelli's Comet of December 1874 are given by J. Holetschek.

COMET 1874, VI.

T = Oct. 18.7391 Berlin time.
π = 298° 46′ 38″
Ω = 281° 38′ 18″
i = 99° 25′ 43″
log. q = 9.71576.

—Burnham notes the discovery of a close companion to β Leporis, dist. 2″, pos. 269°·1, 10th mag. This appears to have been missed by Herschel.—Prof. Bredichin gives differential measures of position of Juno and adjacent stars.—A number of position observations of the minor planets are given by Kowalczyk.—A lithograph of various appearances of Coggia's Comet, drawn by Vogel, accompanies this number.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, Feb. 11.—"Some particulars of the Transit of Venus across the Sun, December 9, 1874, observed on the Himalaya Mountains, Mussoorie, at Marz-Villa Station, lat. 30° 28′ N., long. 78° 3′ E. Height above sea, 6,500 feet."—Note No. I. By J. H. N. Hennessey, F.R.A.S. Communicated by Prof. Stokes, D.C.L., Sec. R.S.

The author observed the event with the equatoreal of the Royal Society, which Capt. J. Herschel, R.E., in his absence from India, had temporarily placed at his disposal. His especial object in view was to observe the transit from *a considerable height*, and this condition was easily secured through the circumstance that he was located only fourteen miles from Mussoorie, on the Himalaya Mountains. His numerical results will be communicated very shortly in a second note. The remarks here made are restricted chiefly to what he *saw* with the equatoreal.

The telescope of the equatoreal has a 5-inch object-glass, with about sixty inches focal length, and is driven by an excellent clock.

The author found from actual trial that the most suitable eyepiece for both ingress (sun's altitude 2° 24′ to 7° 29′) and egress (sun's altitude about 26°) was one of 125 power. He selected for ingress two glasses which, combined, gave a neutral or bluish field; and for egress he changed one of these for a deep-red glass, so that the field now presented a moderately deep red. The glasses were quite flat, and lay against one another in intimate contact, giving excellent definition. He enjoyed most exquisitely clear weather during his observations.

In describing the phenomena of the transit, the author has occasion to speak of Venus as she appeared *across* the sun's limb, when one portion of her own limb is seen against the sun, and the other remains against the sky. The former portion he calls Venus's sun-limb, or V_n, the latter Venus's sky-limb, or V_k. Again, he requires to mention a ring of light around V_k, which he indicates by L_k, the corresponding ring around V_n being understood by L_n. Another point is this: anyone who has watched, say the sun's limb, especially at a low altitude and with high power, must be aware of the turmoil or ebullition which there appears, very like as if the limb was being boiled. He denotes this kind of turmoil by "boiling."

The author did not detect Venus's limb until after it had made an indentation on the sun's limb. The latter boiled sensibly, but by no means violently. It appeared jagged, and as if with minute spikes projecting inwards, all of which were well defined in the bluish field. Watching V_n, he found it also boiling slightly, but in a manner somewhat different to the sun's limb. The appearance was that of boiling vapour coming round from the face of Venus, turned towards the sun and overlapping V_n; moreover, this boiling was not restricted to the edge of V_n, but extended 2″ or 3″ beyond, thus forming a kind of boiling annulus, in which there were minute sparkling specks dancing and shifting about, appearing and disappearing; the edge V_n was seen through the boiling.

Neither pear-drop nor ligament was seen either at ingress or egress.

Col. Walker, who was at Dehra Doon, in the valley below, some ten miles south of Mr. Hennessey's position, writing to the author, states that he "saw the pear-drop and the ligament very distinctly."

After describing his own observations, the author concludes as follows:—

1. In view of the light-ring L_k, and of the peculiar boiling annulus around V_n, which may be called L_n, I have no doubt that L_n was, in fact, a continuation of the light-ring L_k, *which latter, beyond all question, was plainly visible;* and under these circumstances it may be urged that Venus is surrounded by an atmosphere which at the time was made *visible* to the extent of 2″ to under 4″ in breadth.

2. As a matter of fact, the pear-drop or other ligament was visible at a height of 2,200 feet, but at 6,500 feet the ligament was invisible. The influence generally of height of station, from this evidence, appears undeniable; but the phenomenon still remains to be accounted for definitely. If, however, an effective atmosphere of x breadth around Venus be conceded, this atmosphere may be supposed to stop a certain amount of direct light from the sun, producing a slight shade around Venus corresponding to the breadth x. This shade would, I conceive, be quite invisible when its outer edge is backed by the sun's bright light; but could we contract the sun to a diameter equal to that of Venus *plus* twice x, and make Venus and the sun concentric, it appears likely that we should see a shaded annulus right round Venus between her limb and that of the sun. Further, that the annulus would appear darker at low than at higher altitudes, and would become invisible when the observer was raised above a sufficiency of the earth's atmosphere. Should these suggestions prove tenable, the ligament seen would break when the outer edge of the shade, corresponding to x, transited across the sun's limb.

3. Solar light shining through Venus's atmosphere, if any, produces no alteration in the lines of the solar spectrum, so far as the dispersion of a single simple prism can show. Also, Venus's face, turned towards us, reflects no light during transit, subject to the same instrumental test.

"Appendix to Note, dated November 1873, on White Lines in the Solar Spectrum," by J. H. N. Hennessey, F.R.A.S. Communicated by Prof. Stokes, Sec. R.S.

After detection of the white lines 1650 and 1658 (Kirchhoff's scale) at Mussoorie in November 1873, I discovered two other such lines before leaving that station of observation, viz. 2009 and 2068 (about). On 28th November, 1873, I packed up the spectroscope, taking particular care that the prisms should not shift from the position they then occupied.

On 28th November, 1873, I set up the spectroscope in the Dome Observatory at Dehra, in the valley below, the prisms retaining their former position, and my recollection of the white lines seen at Mussoorie being still quite vivid. I now found that 1650 and 1658 were distinctly seen; but they were no longer nearly of the pure white colour they presented at the higher station, while what may be termed the gloss about their whiteness, which induced me to describe them as resembling "threads of white silk held in the light," had quite disappeared; indeed they were now so decidedly greenish as not to invite attention. White line 2068 I now could hardly see, and 2009 was invisible, notwithstanding that I was quite familiar with the positions they occupied, and had made careful notes on the subject.

After this I released the prisms and turned them about variously, without producing any alteration in the white lines as they were now seen.

The height of the spectroscope above sea-level was—

At Mussoorie	...	...	...	...	7100 feet.
,, Dehra	...	...	...	...	2200 ,,

Anthropological Institute, Feb. 9.—Col. A. Lane Fox, F.S.A., president, in the chair.—The President exhibited a series of stone implements from the Alderley mines of Cheshire, and Dr. J. Simms exhibited five Lapp skulls.—A paper by the Rev. Wentworth Webster was read on the Basque and the Kelt, an examination of a paper by Mr. Boyd Dawkins, F.R.S., on the northern range of the Basques, in the *Fortnightly Review* of

September 1874. The author commenced by pointing out the danger of the tendency to extreme specialisation among scientific men of the present day, and proceeded to show how the "Basque problem" had suffered through that treatment. It had been taken up by pure philologists and pure anthropologists, who had viewed it only from their particular standpoints, and had too much neglected historical and archæological researches, folk-lore, literature, drama, and, strangest of all, the physical characteristics of the present Basques. The chief aim of the paper was to show how inconclusive was the evidence of anthropology alone, and to examine Mr. Dawkins' arguments. It held that, firstly, philology had demonstrated the Basque language to be agglutinative; secondly, that W. von Humboldt's conclusion is correct as to the existence of Basque names in the classical geographies and itineraries of Spain; and, thirdly, that although the identity of Basque and Iberian cannot be considered as perfectly demonstrated, its probability is very high. The special point of dispute was the conclusion of Mr. Dawkins that "the former presence of an Iberian race in Armorica is demonstrated by Dr. Broca's map of the stature and complexion of the peoples of France." The author at great length examined and analysed the maps referred to and the statistics cited in the paper, and found that the evidence from anthropology alone did not seem sufficient to support the theory combated, and all other evidence would appear to be opposed to it.—Prof. Boyd Dawkins having replied to the Rev. W. Webster's criticisms, which, in the main, appeared to him to be founded upon a misapprehension of his use of the term "Iberian," Prince L. Lucien Bonaparte remarked that the paper offered scarcely any point in which he could not cordially concur, especially where the author referred to the high competency of W. von Humboldt in respect to the Basque language and ethnology; in fact, it was impossible to dispute the superiority of that eminent philologist on that special question over every modern author not by birth a Basque. He (the Prince) maintained that it would be as presumptuous to affirm that language is always a test of race as it would be, at least, hazardous to declare that anthropologists should invariably dispense with such a test. If an unimportant minority of philologists pretend to dominate over the anthropologists, they are wrong; but the minority of anthropologists, who maintain that language should not be considered in the determination of race, are still more in error.—Rev. A. H. Sayce, as a philologist, maintained that language could not be held to be a test of race; it was a test only of social contact.—Mr. Hyde Clarke vindicated the claims of philology as a branch of anthropology and of natural science. He thought the Basque area of W. von Humboldt should be much limited. The Basque had affinities with Houssa, and was thus connected with dark populations.—Mr. W. J. Van Eys remarked that Humboldt had not proved the Basques to be Iberian.—Prof. Busk, Mr. J. Rhys, Prof. Hughes, Dr. Simms, and Dr. Beddoe, also contributed to the discussion.

Geologists' Association, Feb. 5.—W. Carruthers, F.R.S., president, in the chair.—On the volcanic geology of Iceland, by W. L. Watts. Iceland is situated at the termination of the great volcanic line, skirting the extreme west of the Old World, which has existed since the Cretaceous period certainly, whilst the points of eruption appear to have travelled northwards. As all the rocks are igneous, or igneous derivatives, no stratigraphical arrangement can be made out. Basaltic lava streams are common in the vicinity of Reykjavik, though no active volcano exists in this part of the island, which is in the secondary stage of solfataras and hot springs. These solfataras are mere pits of bluish white siliceous mud, the result of the decomposition of contiguous tufa. The principal gas exhaled is sulphuretted hydrogen. Their position changes. The hot springs are working out their own destruction by the accumulation of sinter; the composition of this varies in springs within a few yards of each other. The large rifts in the old lava at Thingvalla were attributed to the flowing away of the undercurrent of lava into a yet deeper depression, thus leaving the unsupported crust to sink down in the middle. All the lavas of Hekla observed by the author are basaltic, and contain crystals of felspar and olivine. An ash and cinder cone forms the summit of the mountain. There were four craters; the longest one is an elliptical depression 250 feet deep, at the bottom of which lay snow, though some ashes and clay were still quite hot. The district of Mydals Jokull, containing the terrible volcano Kotlujia, is remarkable for the confused intermixture of aqueous and igneous ejectamenta, producing agglomerates and tufas. Sand and hot water are the principal productions of Kotlujia itself, which has not been known to produce lava, though ancient felsitic lavas were noted at its base. These floods are produced, in addition to the melting of the Jokull, by the bursting of large cavities in which water has accumulated for years. Such a reservoir was noted in a small neighbouring crater, at the bottom of which was a deep pool of turbid water, into which several small streams emptied themselves, but none ran out again. To Vatna Jokull the principal volcanic forces of Iceland seem now to have retreated. This is a vast tract of snow and ice which rests upon a nest of volcanoes, many of which have been in eruption during historical times. The Vatna rises from a series of basaltic platforms. The existence of permanently active volcanoes in the unknown interior of this mass was considered not improbable.

EDINBURGH

Royal Society, Feb. 15.—Sir William Thomson, president, in the chair.—The following communications were read:—Obituary notice of Dr. Robert Edward Grant, late Professor of Comparative Anatomy in University College, London, by Dr. Sharpey.—An illustration of the relative rates of diffusion of salts in solution, by Prof. Crum Brown.—On the oscillation of a system of bodies with rotating portions, by Sir Wm. Thomson.—Laboratory notes, by Prof. Tait.

Meteorological Society, Feb. 10.—This was the half-yearly meeting of the Society. Mr. Milne Holme presided.—The Chairman read the report of the Council, of which the following is a summary:—The number of the Society's stations in Scotland was at present 92, and there were also 11 in other countries. The number of members was 538 ordinary, 15 corresponding, and 8 honorary members. After referring to the inquiry conducted by Dr. Arthur Mitchell and Mr. Buchan on the influence of the weather on mortality and disease, the report noticed that, on the suggestion of Mr. Thomas Stevenson, C.E., schedules had been supplied to the observatories within twenty or thirty miles of Edinburgh, so as to secure data for investigating the relation of the force of the wind to the barometric gradient. Returns had been received, but these had not yet been examined. Meteorological returns applicable to Loch Fyne for the last twenty years had been furnished by Mr. Buchan on application to the Special Commissioners appointed to inquire into the causes of the disappearance of herrings from Loch Fyne. The investigations regarding the herring fisheries on the Scottish coasts, instituted by the Society, had been continued during the past session. The Marquis of Tweeddale, who originally suggested the inquiry, had supplied the Society with twenty thermometers, to be used to ascertain the temperature of the sea at the places and at the times when the fishery was being carried on. These thermometers were by Mr. Bouverie Primrose sent to the fishery officers of the Herring Board stationed along the east coast of Scotland, and each fishery officer selected an intelligent fisherman to take the temperature of the sea where the herring shoals were found. Important results were expected from these investigations.—Dr. Arthur Mitchell read a paper on the effects of the weather of the last three months on the death-rate.—Mr. Buchan read a paper on the bearing of meteorological records on the supposed change of climate in Scotland. Mr. Buchan concludes that there has been no general tendency towards a permanent change, either as regards summer heat or winter cold.

MANCHESTER

Literary and Philosophical Society, Jan. 26.—Edward Schunk, F.R.S., &c., president, in the chair.—A descent into Elden Hole, Derbyshire, by Rooke Pennington, LL.B. Near the road from Buxton to Castleton, and about four miles from the latter place, stands Elden Hill, in the side of which is Elden Hole, a perpendicular chasm in the rock, and, like many such apertures, reputed to be bottomless. The author describes a descent into the cavern, made by himself and others, on the 11th of September, 1873. At a distance of 180 ft. from the top a landing-place was reached, although not a very secure one, as it was inclined at an angle of about 45°. Thence a cavern ran downwards towards the south or south-east; the floor was entirely covered with loose fragments of limestone, probably extending to a considerable thickness. There was quite sufficient light at this point to enable one to sketch or read. The party then scrambled, or rather slipped, into the cavern for some few yards, during which they descended a considerable distance: it was of a tunnel-like shape; then it suddenly expanded into a magnificent hall about 100 ft. across and about 70 ft. high. The floor of this half

sloped like the tunnel, and like it was covered with *débris*. At the lower side they were about 60 ft. below their landing-place, and therefore about 240 ft. beneath the surface. The entire roof and walls of this cavern were covered with splendid stalagmitic deposits. From the roof were hung fine stalactites, whilst the sides were covered with almost every conceivable form of deposited carbonate of lime. In some places it was smooth and white as marble, in other places like frosted silver, whilst the rougher portions of the rock were clothed with all sorts of fantastic shapes glistening with moisture. From this cavern no opening of any length or depth was found save the one by which the party had entered it. There can be no doubt, the author believes, that this chasm has been formed by the chemical action of carbonic acid in water, and that it has attacked this particular spot either from the unusual softness of the rock originally situated here, or because there was here a joint or shrinkage in the strata. There is nothing, however, in the position of Elden Hole to lead one to suppose that any stream has ever flowed through it; no signs of such a state of things appear anywhere around. It is not related to any valley or ravine, or to any running water, and there is, as observed, an absence of any well-defined exit for water at the bottom. No mechanical action of a flowing stream can therefore have assisted the process of enlargement. The author thinks it must be due to the gradual silent solvent properties of rain-water falling on the surface, and escaping through jointings and insignificant channels in the hard rocks below. Whether the excavation took place from above or below is uncertain.—Certain lines observed in snow crystals, by Arthur W. Waters, F.G.S.

Glasgow

Geological Society, Jan. 14.—Mr. John Young, F.G.S., vice-president, in the chair.—Mr. D. Bell read a paper on the geology of Switzerland, embodying some observations made during a recent visit to that country.

Philosophical Society, Dec. 2.—Physical Section.—The following papers were read:—On the absence of air and water from the moon, by Mr. Francis Napier.—Experiments on fluid jets and induced currents, by Mr. Alex. Morton.

Dec. 16.—On an apparatus for testing the lubricating powers of various liquids, showing some hitherto unrecognised facts at variance with the commonly received laws of friction, by Mr. R. D. Napier.—On the effect of Loch Katrine water on various metals, by Mr. Jas. R. Napier, F.R.S.

Paris

Academy of Sciences, Feb. 8.—M. M. Frémy in the chair.—The following papers were read:—A remark by M. Puiseux on M. Genocchi's paper read at the last meeting with regard to the existence of the integral in equations with partial derivatives.—A letter from M. Janssen, dated Kompira-Yama (Japan), Dec. 10, 1874, describing the general results of the observations of the Transit of Venus. The first part of the letter shows that the party of observers suffered much from bad weather during their installation at Kompira-Yama, near Nagasaki. During a heavy gale one of the equatorials was completely destroyed, the telescope and micrometer broken, but their outfit was excellent, and before the day of the transit arrived they were able to repair all the damage done. Both the first outer and inner contacts, as well as the second inner one, were successfully observed, and only the last outer one missed through clouds. No black drop appeared at the sun's limb, although M. Janssen remarks that a considerable time elapsed between the moment when the first inner contact appeared geometrically perfect and the re-appearance of a fine line of sunlight beyond the disc of Venus; this M. Janssen ascribes to the planet's atmosphere.—On the general theorems of the displacement of a plane figure on its plane, by M. Chasles.—A note, accompanied by the presentation of an autograph mathematical treatise, by M. Faye.—On the magnetisation of steel rods provided with armatures, by M. J. Jamin.—A note by M. Chevreul on M. Menier's paper, read at the last meeting, on the pulverisation of manures and the best means to increase the fertility of soils.—A memoir by M. Des Cloiseaux, on the bi-refractive and characteristic optical properties of the four principal triclinic felspars, and a process to distinguish them immediately from each other; four felspars the author treats of are albite, oligoclase, labradorite, and anorthite.—On an easy method to determine the latitude of a place without instruments and with sufficient correctness, by M. d'Avout; the method is based on the observations of the shadows of two points situated in a vertical at known distances, projected upon a horizontal plane, the observations being made both before and after the sun's passage through the meridian.—On the fertilisation of Basidiomycetes, by M. P. van Tieghem.—A note on M. Mendeleef's new balance, by M. Salleron.—On rolling-curves obtained by photography, by M. Huet; an ingenious process to note down permanently the curves described by ships rolling in heavy seas.—On a new electro-magnet, formed by concentric tubes separated by layers of conducting wire, by M. J. Camacho.—On the place to be given to Gymnosperms in natural classification, by M. L. Lerolle.—Several communications on Phylloxera, by MM. Lichtenstein, Boutin, Hemmerich, and others.—A note by M. C. Guérin, on an electric pile similar to Bunsen's, but in which zinc would be replaced by iron.—A note by M. G. Peyras, on the use of fumigations to combat murrains.—A letter from M. Fua, with reference to his former communications on the means to prevent explosions in coal-pits.—A note by M. Houzé de l'Aulnoit, on articular immobilisation applied to the dressings of the amputated.—MM. Henry and Baillaud communicated their observations of planet (141), made at the Paris Observatory.—On the existence of integrals of any system of differential equations, by M. C. Méray.—A note on his paper, read at the last meeting, on the molecular equilibrium of a solution of chrome alum, by M. Lecoq de Boisbaudran.—On the action of hydrate of baryta upon certain mineral and organic compounds contained in beet-products, by M. P. Lagrange.—On so-called *rooty* beetroot, by M. C. Violette.—On the peripherical nervous system of marine Nematoidea, by M. A. Villot.—An account of experiments made by M. Philipeau, showing that the paps extirpated from young pigs will not regenerate.—General Morin presented to the Academy a new part of the *Revue d'Artillerie*, published by order of the War Minister, and made some remarks on the contents.

BOOKS AND PAMPHLETS RECEIVED

British.—Marsden's Numismata Orientalia: E. Thomas, F.R.S. (Trübner).—Anleitung zu Wissenschaftlichen Beobachtungen auf Reisen: Dr. G. Neumayer (Trübner).—Number; a Link between Divine Intelligence and Human: Charles Girdlestone, M.A. (Longmans).—Weinhold's Introduction to Experimental Physics. Translated and edited by Benj. Loewy, F.R.S. (Longmans).—Heredity and Hybridism: Edward W. Cox, S.L. (Longmans).—The Cone and its Sections treated Geometrically: S. A. Renshaw (Hamilton, Adams, and Co.)—Statistical Society Almanack for 1875 (E. Stanford).—Animal Physiology; the Structure and Functions of the Human Body: John Cleland, M.D., F.R.S. (Wm. Collins).—Physical Geography: John Young, M.D., L.R.C.S. (Edin.), F.G.S., F.R.S.E (Wm. Collins).—Proceedings of the Literary and Philosophical Society of Liverpool.—Six Months among the Palm Groves, Coral Reefs, and Volcanoes of the Sandwich Islands: Isabella L. Bird (Murray).—Humboldt's Natur-und Reisebilder: C. A. Buchheim, Ph.D., F.C.P. (F. Norgate).—An Introduction to Human Anatomy, including the Anatomy of the Tissues: Wm. Turner, M.B. (A. and C. Black).—Lessons in Elementary Mechanics: Philip Magnus, B.Sc., B.A. (Longmans).—Fungi: their Nature, Influence, and Uses: M. C. Cooke, M.A., LL.D. Edited by the Rev. M. J. Berkeley, M.A., F.L.S. (Henry S. King and Co.)

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DIARY OF SOCIETIES.

LONDON

THURSDAY, FEBRUARY 18.

ROYAL SOCIETY, at 8.30.—On the Nature and Physiological Action of the Crotalus Poison as compared with that of Naja Tripudians, and other Indian Venomous Snakes; also Investigations into the Nature of the Influence of those Poisons on Ciliary and Amœboid Action and on Valisneria, and on the influence of Inspiration of Pure Oxygen on Poisoned Animals: Dr. T. Lauder Brunton, F.R.S., and Dr. Fayrer.

SOCIETY OF ANTIQUARIES, at 8.30.—Ballot for the Election of Fellows.

LINNEAN SOCIETY, at 8.—On the Structure, Affinities, and probable source of the large Human Fluke (*Distoma crassum*, Busk): T. T. Cobbold, M.D., F.R.S.

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FRIDAY, FEBRUARY 19.

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ANTHROPOLOGICAL INSTITUTE, at 8.—On the Milanows of Borneo: Lieut. C. C. de Crespigny.—History of the Heung-Noo, Part II. Translated by A. Wylie, with Notes by H. H. Howorth.

WEST LONDON SCIENTIFIC ASSOCIATION, at 8.—Chemistry of the Voltaic Pile: Dr. J. H. Gladstone.

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SOCIETY OF ARTS, at 8.—On the Mercantile Marine of Great Britain: Capt. Bedford Pim. Adjourned Discussion.

THURSDAY, FEBRUARY 25.

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LONDON INSTITUTION, at 7.—Physiology of Sleep: Dr. Richardson.

TORQUAY

MONDAY, FEBRUARY 22.

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MANCHESTER

TUESDAY, FEBRUARY 23.

GEOLOGICAL SOCIETY, at 3.

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